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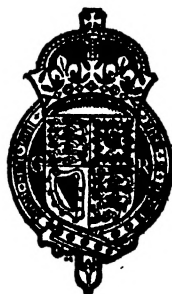
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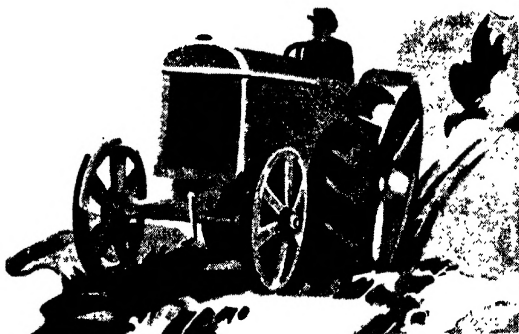
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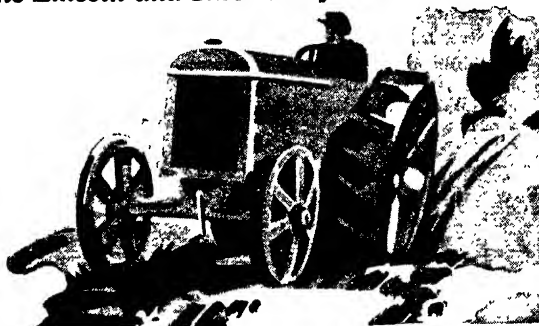
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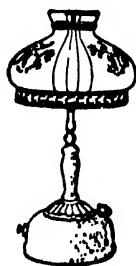
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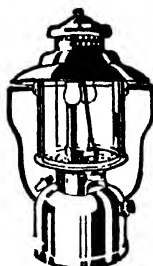
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THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXVI. No. 1.

APRIL, 1929.

NOTES FOR THE MONTH

THE Ministry has just issued a new Miscellaneous Publication, entitled "The Culture of Fish in Ponds: A summary of the successful methods employed in fish-farming countries."* It is perhaps owing to the ease with which sea fish can be made available to the inhabitants

of this country that the cultivation of freshwater fish on a commercial scale is practically unknown. There is, too, the belief that such coarse fish as carp, bream, and even pike, are unpalatable. On the Continent, on the other hand, many kinds of coarse fish, which here are seldom eaten, are considered great delicacies, and in many European countries there exist large establishments which are devoted solely to the production of fish for the table.

It is quite certain that fish culture could be carried out successfully in this country, and once the prejudices against carp and other fish were overcome, commercial success might confidently be expected. The new publication gives a concise account of the fish culture methods which have been employed with such conspicuous success on the Continent and in America, and includes sections on suitable species of fish ; the necessary ponds, their construction, purpose and size ; water supply ; aquatic plants ; natural and artificial foods ; spawning ; commercial aspects and revenues. There is also a section on fish-keeping as distinguished from fish culture. The latter is taken to mean breeding and rearing of fish, and requires a succession of ponds and the attention and labour equivalent to that given to a poultry farm. Fish-keeping is defined as the fattening, either for table or pleasure, of young fish which have been purchased from a culturist. Fish-keeping needs but one pond, maybe only a few yards square, and too much emphasis cannot be laid upon the value, to all who already have ponds,

* Miscellaneous Publications, No. 64, obtainable from the Ministry, 10 Whitehall Place, London, S.W. 1 ; price 4d. net, post free.

of keeping or fattening fish which can be obtained from breeding establishments. Indeed, it is within the bounds of possibility for any garden-owner to construct an ornamental pond at a trifling cost, purchase a few fish from a breeding establishment, succeed with them, and then go more extensively into keeping and fattening fish for household use, ultimately breeding them.

The publication now issued cannot fail to arouse interest in a subject which offers such wide possibilities of development.

* * * * *

It is announced that the fourteenth International Agricultural Congress will be held at Bucharest on June 7, 8 and 10, 1929, under the distinguished patronage of His Majesty the King of Roumania. It is fitting that this Congress should be held in an essentially agricultural country like Roumania. As indicating the importance of these biennial Congresses, which are organized under the auspices of the International Agricultural Commission, it may be mentioned that the last Congress, which was held in Rome in May, 1927, was attended by 1,000 persons, including representatives of 40 Governments and of the League of Nations.

Membership of the Congress is open, *inter alia*, to members of the International Agricultural Commission and delegates of (a) agricultural associations throughout the world; (b) technical and scientific institutions whose object is the encouragement of agriculture, and (c) the International Agricultural Institute and the International Labour Bureau. The Roumanian Government has invited all countries to participate in this Congress.

The work of the Congress will be divided into seven sections. The subjects to be dealt with include agricultural economics, co-operation and marketing, horticulture (including vine culture), stock raising and wool production, the sugar beet industry, and fresh water fisheries. It is worthy of note that one section will be devoted solely to the consideration of the position of women in rural life, and the measures that should be taken for improvement.

Further particulars of the Congress may be obtained from the Secretary, Comité d'Organization, XIV^{me} Congrès International d'Agriculture, Strada C. A. Rosetti, 35, Bucarest 1, Roumania.

PRELIMINARY figures for the 1928-29 beet sugar manufacturing campaign have been received. The area under sugar beet, as shown by the Agricultural Returns for June 4, 1928, was 175,736 acres, a reduction of 21 per cent. on the 1927 acreage. This fall in acreage may be attributed in the main to two causes:—

The 1928 Sugar Beet Crop in England and Wales

- (1) The reduction in the grower's price consequential on the reduced rate of subsidy.
- (2) The poor average crops obtained in 1927 as a result of adverse climatic conditions.

Only one new factory—at Brigg, in Lincolnshire—was erected in 1928, the total number of factories in operation being 18.

An improved yield per acre, 7·8 tons as against 6·5 tons in 1927, largely counteracted the lower acreage and resulted in the total quantity of beets delivered to factories being about 1,374,800 tons as against 1,449,152 in the previous year. The average sugar content was 17·32 per cent. as against 16·12 per cent. in 1927. The higher sugar content improved the factories' outturn of commercial sugar, which is estimated to have been 3,900,000 cwt. as against 3,651,620 cwt. in the 1927-28 campaign. This means an average of about 2,500 lb. per acre of beet under cultivation as compared with 1,838 lb. in 1927.

On the whole, climatic conditions in 1928 were favourable to the crop, except for a spell of cold and dry weather at the end of April and beginning of May, which retarded germination and early growth. Harvesting was carried out under satisfactory conditions and resulted in the beet deliveries being much cleaner than in the previous season, the average tare being 14·5 lb. per cwt. as against 20 lb. during the previous campaign.

The average price paid for beets under the contract was about 51s. 9d. a ton compared with 55s. 6d. in 1927, the decrease being due to the reduced basic price consequent on the fall in the rate of subsidy.

About 97,000 tons of dried pulp and 11,000 tons of wet pulp were produced during the 1928-29 campaign, compared with 88,000 tons and 15,000 tons respectively in the previous one. It is satisfactory to note that over 90 per cent. of the dried pulp was sold for home use as against 75 per cent. in 1927-28. The production of molasses is estimated at 1,010,000 cwt.

ONE of the recommendations of the Imperial Agricultural Research Conference, 1927, was for the preparation and issue of a statement of facilities for **Advanced Study in Agricultural Science** study and research in agricultural science and the cognate pure sciences, with a view to arrangements for study leave for agricultural research workers in the Empire. A volume giving particulars of such facilities in the United Kingdom has been prepared as a result of this recommendation. It contains particulars of :—

- (1) Institutions carrying out agricultural research, with the names of the principal members of the staff, a short appreciation of fields of research, and an account of facilities for research.
- (2) The names of University professors in pure sciences cognate to agriculture, arranged under the respective sciences.
- (3) The names of professors, readers and lecturers in agriculture and cognate pure sciences at the various universities, etc., at which agricultural research and teaching are carried out.

Copies of the volume are obtainable from the Ministry, 10 Whitehall Place, London, S.W. 1, price, post free, 1s. net.

* * * * *

A FURTHER recommendation of the Imperial Agricultural Research Conference, 1927, was that the List of Agricultural Research Workers in the Empire, prepared for the Conference, should be revised and circulated periodically. This list has accordingly been revised to show the names of agricultural research workers in 1928 with their investigational subjects. It gives the principal officers in the British Empire, the whole, or the major part, of whose duties consists in the carrying out of agricultural research. The information is given, in the first place, according to country; and, in the second, according to subjects, the latter arranged in alphabetical order. The data for the compilation of the list were supplied by the respective Governments of the different countries. Copies are obtainable from the Ministry, 10 Whitehall Place, London, S.W. 1, price, post free, 1s. net.

THE Ministry is offering 130 scholarships for courses at farm institutes, agricultural colleges, veterinary colleges and universities for the sons and daughters of agricultural workmen and other persons engaged in agricultural work who are in a similar economic position. The scholarships enable young agricultural workers to improve their technical knowledge, so that in later life they may have a better chance of making headway in the industry on which their livelihood depends. Since the commencement of the scholarship scheme in 1922, 841 men and women have been assisted and the results of training are encouraging. A large number have succeeded in improving their positions, the posts ranging on the practical side from foreman to estate manager, and on the educational side from assistant instructor to government inspector.

The selection of candidates is by interview; no written examination is required. Practical experience in agricultural work is a very desirable preliminary to the courses of instruction—except scholars proceeding to universities direct from secondary schools—and, other things being equal, preference is given to applicants who have a good knowledge of ordinary farm work, or dairying, horticulture, or poultry-keeping, as the case may be. The value of the scholarships is sufficient to enable the recipients to attend the various institutions without cost to themselves or to their parents.

Information about the scheme, including a leaflet outlining the careers open to scholars, and forms of application, may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, S.W. 1, or locally from the offices of County Councils. The last date for receiving applications is April 30, 1929.

* * * * *

IN addition to the list of Marketing Demonstrations at Agricultural Shows, given in last month's (March) issue of the JOURNAL, the Ministry will stage a pig marketing demonstration at the Highland Show at Alloa on July 23-26, and a fruit marketing demonstration at the Kent County Show at Folkestone on July 18-20.

As a result of complaints received from feeders in this country that deleterious results followed the feeding to pigs of an American Barley known as No. 2 Federal Barley, the Ministry of Agriculture and Fisheries is carrying out a series of experiments with samples of cargoes of this barley received at British ports. These experiments have not yet been completed, but there is no doubt that certain lots of the barley have been shown to cause vomiting when fed to pigs, and that the lots in question have been found to be affected with a parasitic fungus disease, *Gibberella Saubinetii*—grain attacked by which is known to be toxic to man and domestic animals. The Ministry is in communication through the Foreign Office with the Authorities of the United States on the subject.

* * * * *

It has been decided to organize an Agricultural Meteorological Section of the Empire Meteorological Conference which is being held in this country under the auspices of the Air Ministry in August next. The organization of this Agricultural Meteorological Section has been entrusted to the Agricultural Meteorological Committee, and the Secretary of that Committee, Mr. W. R. Black, M.B.E., B.Sc., has been appointed to act as Secretary of the Section at the Conference. Papers are being invited from workers in this country and overseas, and accounts of the organization of agricultural meteorological work in this country, in the overseas Empire and in foreign countries, will be prepared. It is proposed that the question of co-operation in agricultural meteorological work in the Empire shall be further developed at the Imperial Agricultural Research Conference in 1932. The cost of organization of the Agricultural Meteorological Section at the forthcoming Conference in August is being borne by the Empire Marketing Board.

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**Success of
An Untrained
Smallholder**

EIGHT years ago, a resident in the Portsmouth area, who was out of work but had a little capital at his disposal, decided to invest his money in the purchase of $1\frac{1}{2}$ acres of land in a village some eight miles from his home. He cycled this distance daily for some years, but has recently been able to erect a two-roomed bungalow on the holding. He is now a prosperous market gardener, flowers being his principal source of income, and has erected, in addition to the bungalow, three glasshouses which cost him about £300, apart from the value of his own labour in erection. This man had no practical experience before buying the land, but has achieved his present success with the assistance of a very hard-working and capable wife. He states that he has derived great help from pamphlets obtained from the Ministry.

* * * * *

**Broadcasting of
Market Prices
for Farmers**

THE question of broadcasting daily the average prices realized by graded fat cattle at certain important markets has been under consideration, and during the past few months, the reporters at 10 markets have been furnishing reports as to the prices of fat cattle graded according to certain weights and qualities. Simultaneously, an inquiry was conducted by Major W. H. Warman, of the Markets Branch of the Ministry, and Mr. P. F. Astill, representing the National Farmers' Union, in order to test the accuracy of the quotations and their comparability as between different markets. On completion of this inquiry, the results were discussed with the National Farmers' Union. The conclusions reached were that the reporting, generally, was accurate and the prices were worth broadcasting. The Ministry, therefore, arranged with the British Broadcasting Corporation for a daily broadcast from Daventry 5XX every evening, except Thursday and Sunday, immediately following the Shipping Forecast, which is usually broadcast about 9.30 p.m.

Broadcasting of these prices commenced on Monday, March 11. The information given consists of the average prices at the following markets held during the day of the respective broadcast: On *Monday*, Carlisle market and carcasses at the London Smithfield market; on *Tuesday*, Shrewsbury market; on *Wednesday*, Bridgwater market; on *Friday*, Exeter market; and on *Saturday*, Norwich market.

The average prices are based on certain weights and classes, the details of which have been drawn up by the Ministry in consultation with the National Farmers' Union. There are four classes as follows :—

- (1) *Light Weights*—that is, cattle weighing less than 9 cwt.
- (2) *Medium Weights*—cattle weighing 9 cwt. and under 11 cwt.
- (3) *Heavy Weights*—those of 11 cwt. and over, and
- (4) *Fat Cows*—without distinction of weights.

In each class, except fat cows, there are three qualities : *super quality*, that is, cattle which are estimated to dress when slaughtered at over 64 lb. of meat for each cwt. live weight ; *first quality*, estimated to dress from 58 to 64 lb. per live cwt. ; and *second quality*, estimated to dress under 58 lb. per live cwt. *First quality* fat cows will be those estimated to dress 52 lb. and over per live cwt., and *second quality* under 52 lb.

Apart from this special scheme of broadcasting graded fat cattle prices, the broadcasting of market prices generally has been considerably extended in the last few months. Prior to February, 1928, broadcasting of market prices was confined to one bulletin of five minutes issued from London each Thursday evening between 6 and 7 o'clock, and this was taken by other stations. As a result of negotiations with the British Broadcasting Corporation, it was found possible to arrange for the local stations at Manchester, Cardiff and Bournemouth to substitute, for this weekly broadcast of average prices for the whole country, a broadcast of prices realized at markets in the areas served by those stations. It is expected that a similar broadcast will shortly be instituted for the Newcastle area. Unfortunately, a large area of the country, including the Eastern Counties and a great part of the Midlands, is not covered by local stations and can only be reached from Daventry 5XX. It is hoped that it may be possible, at an early date, to make some arrangement with the British Broadcasting Corporation whereby these areas are provided with a broadcast of prices at their more important markets.

The degree to which these local broadcasts can be extended is limited. The British Broadcasting Corporation has a natural reluctance to overload programmes with specialized information ; but as soon as the new regional stations with double wave-lengths are functioning (the new London Station is in course of construction and the others are being planned) it should be possible to approach the British Broadcasting Corporation again with a proposal for providing farmers throughout the country with a more adequate service of up-to-date market prices.

UNTIL about three years ago, the broccoli produced in Cornwall was grown from local seed, and a large proportion did not produce the firm white "curds" which distinguish the best types. During the last few years, however, a considerable amount of seed from superior strains of broccoli has been obtained on the suggestion and through the agency of the Ministry of Agriculture and Fisheries; Cornish broccoli of these superior strains is now equal to the best.

**National Mark
Export Scheme for
Cornish Broccoli**

In January of the present year, a deputation of broccoli growers from Cornwall, accompanied by the County Horticultural Superintendent, visited the Continent to investigate the possibilities of marketing Cornish-grown broccoli in the more important centres. The deputation formed the opinion that Cornish broccoli was likely to find a satisfactory market in Germany and Belgium, if properly graded and packed, and they accordingly approached the Ministry for permission to use the National Mark on broccoli so exported.

In exercise of the powers conferred on him by the Agricultural Produce (Grading and Marking) Act, 1928, the Minister has made Regulations* prescribing grade designations and grade designation marks for broccoli. The quality indicated by the grade designations is set out overleaf. The final scheme was drawn up by the Ministry in consultation and agreement with the County Horticultural Superintendent and the Cornwall Branch of the National Farmers' Union.

Seven growers have applied for permission to use the National Mark, and 5,000 National Mark labels in French and German have been issued to them. One of the labels is affixed to each end of the non-returnable wooden crate in which the broccoli is dispatched.

The first consignment was sent to Brussels, *via* the Harwich-Zeebrugge Ferry, on February 26; it consisted of 148 crates each holding 12 heads. Figs. 1 and 2 show inspection of the broccoli. The consignment reached its destination without damage and was the subject of highly favourable comment from all who saw it. The prices realized were satisfactory. A second consignment was sent to Cologne on March 12; it is anticipated that other consignments to the Continent will follow. This interesting and enterprising venture is being watched with interest throughout the country.

* Agricultural Produce (Grading and Marking) (Broccoli) Regulations, 1929.

BROCCOLI PRODUCED IN ENGLAND AND WALES.

Grade Designation	Statutory Definitions					Tolerance	
	Curd		Wrapper Leaves		Leaves (length from surface of curd)	Damage by disease, decay or frost (applicable to quantities)	(General (applicable to quantities)
	Mini- mum diameter	(2)	Other characteristics	Length from surface of curd	Other charac- teristics		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(9)
FIRST QUALITY or Prima Qualité or Première Qualité	5½ in.	Compact: free from interveining bracts or leaves: free from damage caused by for- eign matter, disease, decay, frost, bruising, insects or otherwise; free from discolora- tion and not blown, woolly or over-mature.	6 in.	Fresh and green	¾ in.	½ in.	May be per- mitted up to head in 12 may fail 2 sq. in. in to pass the standard the aggregate laid down in cols. 2, per 12 heads 3, 4 and 5, allowing but may not for the tolerances exceed 1sq.in. specified in cols. 6, 7 on any one' and 8, provided that no head shall sub- stantially depart from the standard.

Definitions.—"Compact" means that the flower clusters are closely united in the curd, and the heads are solid to the touch.

"Damage" means any injury which would materially affect the appearance or edible quality of the head.

"Discoloration" means that the head is of abnormal colour.

"Blown" means that the flower clusters of the curd have started to elongate, causing the clusters to separate and give the curd an open appearance.

"Woolly" means that the surface of the curd has a velvety or hairy appearance.

"Over-mature" means a stage of growth which is beyond that of a compact, properly developed head.



National Mark Broccoli. Inspection at Loading Station.

SUGAR BEET DEMONSTRATIONS, 1928

WITH the aid of a grant from the Beet Sugar Factories a scheme of demonstrations, designed to bring before farmers some of the important factors to be observed in the cultivation of sugar beet, was commenced in the principal growing districts in England in 1927, and a report on the broad results of the season's work was published by the Ministry in July, 1928.*

The factories supplied funds to enable the scheme to be continued in 1928, and the general conclusions to be drawn from these further demonstrations, considered in the light of the results of the previous year, are here given. It is well to bear in mind that the scheme as a whole is definitely one of demonstration and not of experimentation, and that its chief value lies in its local application. Further, it should be remarked that, as the report is a generalization of the returns from 13 districts involving 289 separate plots, the more or less conclusive findings in any one area are liable to be modified when comparing the results as a whole. A summary of the reports forwarded from the principal local centres is given in Appendix I.

The Scheme of Demonstrations.—The scheme of demonstrations was the same as that carried out in 1927, except that demonstrations of horse-hoeing and time of singling were omitted, and a comparison of varieties was introduced. Each demonstration was confined to the elucidation of one factor only. Briefly, the general scheme was as follows :—

- (1) *Width between Rows.*—The aim of these demonstrations was to show the effect of different widths between rows of sugar beet, and the most advantageous distance. Plots were divided into three parts, the width between rows in the first part being 18 in., in the second 21 in., and in the third 24 in., the plants being set as far as possible 8 in. apart. Approximate rates of seeding were 15 lb. per acre for 24 in. rows, 17 lb. for 21 in. rows, and 20 lb. for 18 in. rows, the object being to allow the same quantity of seed per row.
- (2) *Ridging.*—This demonstration is of less general importance than the others, but it was undertaken in districts where ridging is common, and in these cases, as a rule, the demonstration was carried out in conjunction with (1) above.
- (3) *Width between Plants.*—Spaces of 8 in., 10 in., and 12 in. were compared in 21 in. rows.
- (4) *Manuring.*—The manurial demonstrations were designed to show (a) the best quantity of nitrogenous fertilizer to use, and (b) the right time to apply it. In the "quantity of nitrogen" trials the plots were prepared in the ordinary way as to dung

* *Sugar Beet Demonstrations* : Miscellaneous Publications, No. 63, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1. Price 2d. net, post free.

(if used) and non-nitrogenous manures, and as regards sections were treated as follows:—

- (i) No nitrogenous fertilizer.
- (ii) 1 cwt. per acre sulphate of ammonia.
- (iii) 2 cwt. " " " "
- (iv) 3 cwt. " " " "

In black fenland areas, the sections (after preparation in the ordinary manner as to dung) were dressed with mineral manures as under instead of nitrogenous fertilizers:—

- (i) No superphosphate or muriate of potash.
- (ii) 4 cwt. superphosphate.
- (iii) 4 cwt. superphosphate and $1\frac{1}{2}$ cwt. muriate of potash.
- (iv) $1\frac{1}{2}$ cwt. muriate of potash.

In the "time to apply" trials, the areas (otherwise prepared in the ordinary way) were divided into three sections and dressed with sulphate of ammonia at the rate of 3 cwt. per acre in the following manner: In the first section the 3 cwt. were put in before the land was worked for drilling; in the second, $1\frac{1}{2}$ cwt. were put in before drilling as in the first case and $1\frac{1}{2}$ cwt. as a top dressing at the time of singling; in the third section no sulphate of ammonia was put in with the seed, but $1\frac{1}{2}$ cwt. at the time of singling and $1\frac{1}{2}$ cwt. as a top dressing not later than three weeks after singling.

- (5) *Varieties*.—As a result of the experience gained in 1927, it was decided that the variety demonstrations should mainly be confined to a comparison of the characteristics and differences in habit of three varieties, namely, Kleinwanzleben E, Dippe E and Kuhn P.

In a few cases, organizers found it desirable to arrange demonstrations on other points, such as sub-soiling, cross-blocking, and the manurial value of lime waste from beet-sugar factories.

Organization.—The organization set up in 1927 was continued. For convenience particulars are appended of the 13 districts in which the trials were conducted.

<i>District</i>	<i>Officer responsible</i>
Norfolk	Director of the Norfolk Agricultural Station.
East Suffolk	Agricultural Organizer.
Isle of Ely	Director of University Farm, Cambridge.
Hunts	
Cambridge	Agricultural Organizer.
Kesteven	" "
Lindsey	" "
Notts	" "
Essex	" "
Salop	" "
Northants	" "
Stafford	" "
Yorks	Professor of Agriculture, Leeds University.
Worcester	Head of Bristol University Advisory Staff in co-operation with the agricultural organizer for each county.
Wilts	
Somerset	
Hereford	
Gloucester	

Weather Conditions in 1928.—Climatic conditions were, on the whole, more favourable to the growth of sugar beet in

1928 than in 1927. Seasonable weather during the winter and early spring enabled farmers to prepare satisfactory seed beds, the importance of which, in the establishment of a good plant, was indicated in last year's demonstrations. Favourable conditions encouraged some growers to sow much earlier than is usual, but a dry spell at the end of April and in the beginning of May, followed by cold weather with rain, retarded germination, to the advantage of the later sown crops. Re-seeding was necessary on some of the earlier sown fields, resulting as a rule in immature and relatively small crops. The growing period was fine and warm, more particularly towards the end, and helped considerably, except in the light dry soils, in the development of the root and in sugar formation, with the result that higher yields of beet and a higher sugar content were obtained than under the abnormally wet and sunless summer of 1927.

Lifting conditions generally were not unduly affected by unfavourable weather, and there was, consequently, an absence of the high dirt tare characteristic of last year's returns.

With better growing conditions the incidence of disease generally appears to have been less. The prevalence of Black Fly (*Aphis*) was, however, the direct cause of the elimination of some demonstrations; at other centres the damage was overcome by the autumn rains. In certain cases, despite good germination, a "gappy" final plant was recorded, owing to attacks on seedling plants by the organism causing "Blackleg" and by wireworm.

Comparisons of Results of 1928 Demonstrations.—*Width between Rows and Width of Singling.*—The general conclusion indicated by the results of last year's demonstrations, that narrower row widths providing a higher plant population per acre show higher yields per acre, is confirmed on broad lines.

Although there were cases where the differences in yields were insignificant, more particularly between the narrower widths, the 24-in. rows gave as a general rule a lower weight of washed beet per acre and a lower sugar percentage than the others.

In so far as the yield per acre of beet is influenced by the number of beet per acre, the width of row factor should be considered in conjunction with the distance between plants. This is borne out by the results of the width of singling demonstrations. In one district the results indicate that where the rows were 21 in. or more apart, lower yields of

sugar per acre were obtained from the wider than from the closer singling. Where the rows were drilled at $19\frac{1}{2}$ in. apart a better yield was obtained by setting out at $12\frac{1}{2}$ in. than at $10\frac{1}{2}$ in.

A reduction of plant population below 25,000 per acre or thereabouts appears to be detrimental to the yield of sugar per acre, and a dense population, *e.g.* 30,000 to 32,000 or more per acre, did not invariably lead to a higher yield of sugar per acre than a population of only 25,000 to 30,000 beets per acre. On good land capable of growing 11 tons of beet per acre, it is claimed that there is no advantage in having more than 28,000 to 29,000 plants per acre, or approximately a distance of 10 in. between plants on 21-in. work and a distance of 12 in. on 18-in. work.

In most districts the demonstrations in width of singling were carried out at distances of 8 in., 10 in. and 12 in., but at a few centres spaces of 6 in., 8 in. and 10 in. were also introduced. The difficulties of singling to the narrower widths are apparent when the actual mean distances between plants are compared with the theoretical distances; for example, at six centres the average distance between plants in the 8-in. widths varied from 9.0 in. to 12.1 in., in the 10-in. widths from 10.4 in. to 13.6 in., and in the 12-in. widths from 12.2 in. to 14.7 in. Provided a full plant germinates and survives, one of the most important factors is the human element. The distance between plants is dependent on the skill of the workman. Greater width of singling makes for easier work.

These results point to the importance of close supervision of this operation.

Ridge versus Flat.—This demonstration was carried out at comparatively few centres. The results are inconclusive and, with the introduction of varying row widths for the two types of work under comparison, they are difficult of interpretation. With equal row widths there would appear to be no significant difference in yield, provided the plant is about equal.

Varying Quantities of Nitrogenous Fertilizer.—The general inference drawn from last year's trials, that dressings up to 3 cwt. per acre of nitrogenous fertilizer showed a definite increase in sugar per acre, except in fen and warp soil, is confirmed. Varying quantities of sulphate of ammonia—1, 2 and 3 cwt. per acre—were tested in comparison with a control plot.

Results vary in different districts as to the maximum quantity for the optimum yield, but a profitable return is

indicated for the use of up to 3 cwt. per acre. The increase in yield of sugar and washed beet per acre is definite, even at centres where dung had been applied.

The correlation between sugar percentage and small quantities of nitrogenous fertilizer applied is indefinite. The results at the majority of centres indicated that the sugar content decreased with increasing dressings of nitrogen. This depression in sugar content was counter-balanced by increased yields of washed beet. The depression of the sugar content was more marked still on the black and warp soils.

It is possible that where the beets were not ripe when weighed, later sampling may have led to results still more in favour of dressings of nitrogen.

The increase in the yield of tops for each additional 1 cwt. of sulphate of ammonia, though not always consistent, was marked at some centres, showing for example up to 50 per cent. increase for 1 cwt. and 100 per cent. increase for 2-3 cwt. per acre over the untreated plot.

At centres where calcium cyanamide was tried the results were very similar to those obtained with sulphate of ammonia.

Time of Application of Nitrogenous Fertilizer.—There seems justification for saying that no advantage is gained by omitting the application of nitrogenous fertilizer until the time of singling. Plots at many centres dressed before seed time, or given one-half before drilling and one-half at singling, yielded more sugar per acre than plots receiving the total quantity as a top dressing later. The saving in time and labour by a single application, in addition to the advantage of avoiding top dressing too late, suggests the application of the nitrogen to the seed bed.

Mineral Manures.—The trials with mineral manures were conducted on fen soils.

On poor fen land, dressings of phosphates and potash show increases in yield of washed beet and sugar per acre in two districts, and evidence was obtained in a third district that some considerable benefit might accrue from the use of mineral manures on very light, peaty, fen soils.

On black fen land in good "heart" no increase in the yield of sugar per acre was evidenced by the application of dressings of superphosphate and muriate of potash whether separately or together. It is interesting to note that in this district plots receiving muriate of potash (either alone or with superphosphate) did not germinate so readily or so evenly

as the others. This was more noticeable when the manures were sown simultaneously with the seed by a combined drill.

The quantities of manure drilled were 4 cwt. per acre of superphosphate (30 per cent.) and $1\frac{1}{2}$ cwt. of muriate of potash. The custom adopted by many growers of sowing up to 2 cwt. per acre of superphosphate by this method produces no harmful effect on germination. In this district the local practice is to apply up to 10 cwt. per acre of superphosphate to the potato crop once in the rotation, and this factor must be considered in interpreting these results in relation to their general application.

Variety Trials.—The trials conducted were more extensive than in the previous year.

A comprehensive comparison of these district trials is not practicable. Kuhn P, Dippe E, Kleinwanzleben E, were introduced into the majority of the trials, and although no one variety was consistently of outstanding merit in relation to yield of sugar per acre, Kleinwanzleben E. gave higher yields of beet, Dippe was characterized by a higher percentage of bolters, and Kuhn P. produced the least amount of top. That the differences in sugar percentages were not more marked is due probably to weather conditions, as the season was a favourable one for sugar formation.

In trials in two districts Marster's seed gave the highest weight of sugar per acre. On a thin wold soil this variety gave better results than Kuhn P. Marster, in comparison with 11 other varieties at another centre, gave a higher sugar percentage, greater weight of washed beet, and consequently a heavier yield of sugar per acre than the other varieties in the demonstration.

The demonstrations on fenland soils included the following varieties, Kuhn P, Dippe E, Kleinwanzleben E. and Z, and Standard. Apart from the more vigorous germination and higher yield of washed beet per acre shown by Kleinwanzleben E., no significant differences were noted.

Waste Lime.—Trials with waste lime from beet sugar factories were conducted at three centres. The lime plot at one centre showed a slightly higher percentage of sugar, $\frac{1}{2}$ ton per acre more of washed beet, and $1\frac{1}{2}$ tons increase in yield of tops. The rate of application was $2\frac{1}{2}$ tons per acre. The effect was most pronounced when the lime was shot in heaps in a corner of the field, but this treatment was probably equivalent to a dressing of several tons per acre.

The results from the other two centres were inconsistent.

Subsoiling.—In one district this demonstration carried out at three centres did not provide consistent results or sufficient data from which to draw any definite conclusions.

In a second district the operation facilitated lifting and enabled the beet to withstand better the drought in the spring.

Cross Drilling and Horse Hoeing.—In one district a successful attempt was made to drill a field in two directions in such a way that it could be horse-hoed in two directions. By this means it was thought that there might not only be a more perfect plant but a reduction in the labour bill.

The field in which this attempt was made was in a most unkind tilth, due to the wet winter and the rather heavy nature of the soil, but it was finally drilled on May 25, 20 lb. of seed per acre being drilled at 21 in. one way, and 10 lb. at 14 in. the other way. An average plant was obtained, and was cross horse-hoed on June 20, leaving "rows" of beet 4 in. long with 3-in. gaps between. Singling was very easy, no finger-work being necessary, and the field was left with four plants on 28 in. (a plant being at each end of the 28 in.), or plants at a regular distance of $9\frac{1}{2}$ in. apart in the rows, and 21 in. between the rows.

The horse-hoeing was carried out in both directions in spite of the unkind tilth, and at lifting time it was nearly impossible to tell whether the field had or had not been drilled in the ordinary way. The manner in which the tines of the hoe were set completely destroyed every other row of the 14-in. work, and the field might have been drilled 20 lb. of seed 21 in. apart and 10 lb. of seed 28 in. apart, the rows at 28 in. being to guide the horse-hoe and to double the chances of a seed growing where the two drillings cut each other.

The following points may be helpful to farmers who wish to attempt cross drilling :—

- (1) To drill a field 18 in. between the rows, and to have the plants 10 in. apart in the rows ;
 - (a) Drill rows 18 in. apart, then rows 10 in. apart at right angles to first drilling ;
 - (b) Horse-hoe across the 18-in. rows, setting the blades as near the 10-in. rows as is safe. Then horse-hoe across the 10-in. rows, setting the blades as near the 18-in. rows as is safe.
- (2) In practice, it is found easier to hoe across the heavy seeding or "permanent" rows first—it is easier to see where the horse-hoe is going.
- (3) The horse-hoe should be set so as to cover as many or half as many rows as the drill, to avoid trouble with different widths of wheel rows or joints in the drilling.

APPENDIX I.

Summary of Reports from Districts.

Norfolk :

Width between Rows.—The difference in yield between 18 in. and 21 in. is negligible where a good crop can be grown. On 24-in. work, however, there is a definite drop. In the case of poorer crops drills wider than 18 in. give a considerable drop in yields.

Ridge v. Flat.—There is no significant difference in yield from ridge work and flat work, provided the plant is about equal.

Width between Plants.—It appears that on good land capable of growing good crops of beet the best financial return would be got by growing on 21-in. drills and singling to 10 in. between the plants.

Nitrogen Trials.—In the "quantity of nitrogen" trials there has been on the average a profitable return up to 3 cwt. of sulphate of ammonia. Out of seven plots in the "time to apply" trials, six favour the application of nitrogen (in the form of sulphate of ammonia) in the seed bed. In the seventh plot weeds came up so badly that the nitrogen was used and "fixed" by them before their suppression by cultivation.

East Suffolk :

Width between Rows and Distance apart of Plants in the Row.—The "width between rows" demonstration was carried out at three centres. Although at two centres there was a slight increase in sugar per acre, as the rows became narrower this increase was not so striking as the increase obtained by leaving the plants closer together at singling. A very large factor in deciding the size of a beet crop is the number of beet per acre.

It is suggested that the best width between rows is a matter which can only be decided on each farm and for each field, as it depends on such factors as the nature and cleanliness of the soil. The closer the rows are together, the greater is the chance of obtaining a large number of beet per acre, as, from the trials, there seems to be little advantage in setting out the plants much closer than 10 in. apart.

The "spacing of plants" demonstrations showed a decrease in sugar and number of beet per acre as the plants became farther apart in the rows. This decrease in sugar was greater with plants from 10-12 in. apart than with those from 8-10 in. apart.

Subsoiling.—There was no marked difference in the "fanginess" of the beet on the two plots. Generally, subsoiling gave a slight increase in yield.

Nitrogen Trials : (a) Quantity.—The trials show that on land in a fairly high state of fertility 2 cwt. of nitrogenous manures might be most profitable. On poorer land it is likely that 3 cwt. would give better results.

(b) Time of Application.—Results were indefinite, but slightly favoured early application. As early application of nitrogen undoubtedly favours early ripening, a crop which is to be lifted early in the autumn should have its nitrogen applied early. If this plan is combined with the selection of an early-ripening strain of seed, heavy early-ripening crops may be obtained.

Variety Trials.—Two trials were carried out with the four strains (E.N.Z. and Z.Z.) of Kleinwanzleben seed to determine the effect on yield of disinfecting the seed with the object of killing any fungus diseases with which it may have been contaminated. The result showed no difference in yield due to disinfection. Three ordinary trials carried out with these four strains produced inconclusive results.

Isle of Ely and Hunts :

Width between Rows.—The trials were conducted at three farms. At two farms the distances were 18 in., 21 in., and 24 in., and on the third 18 in., 22½ in., and 24 in. Farm No. 2 showed a higher yield of sugar per acre from 18 in. rows than from wider rows; at Farm No. 3 the highest yield was obtained from 22½ in. rows. At both centres 24-in. rows gave the lowest yield, and it seems probable that this low yield may be correlated with a low plant population—a conclusion supported by results at Farm No. 1, where even 21-in. rows gave a yield as low as 24-in. rows, when the number of beets per acre fell to 21,000 owing to wide singling. At all three centres the 18 in. plots carried 30,000 plants per acre, but only at Farm No. 2 did this dense population result in a higher yield of sugar per acre than where the number of beets per acre lay between 25,000 and 30,000.

Width between Plants.—Where rows were 21 in. or more apart, lower yields of sugar per acre were obtained from wide (12 in.-13 in.) than from close (8 in.-9 in.) singling. Where rows were 19½ in. apart a better yield was obtained from singling to 12½ in. than from 10½ in. It should be borne in mind that even 12½ in. singling on these narrow rows leaves a relatively good plant population—in this case over 25,000 beets per acre.

Nitrogen Trials.—The application of sulphate of ammonia in the "quantity of nitrogen" trials was carried out on highland as distinct from fenland soils, and only two centres were arranged. There was an increased yield of washed beet, the increase varying from one to two tons per acre, despite the fact that dung was applied at both centres. No benefit resulted from using more than 1 cwt. per acre. The effect of the manure on sugar content was inconclusive. The weight per acre of leaves and crowns was increased; at one centre no further increase was recorded when the dressing was increased from 1 cwt. to 2 and 3 cwt. per acre, but at the other centre a gradual increase was obtained from dressings up to 2 cwt. per acre. In the "time to apply" trials the evidence was in favour of the application of full dressings of sulphate of ammonia at the time of drilling.

Use of Mineral Manures on Fenland Soils.—Ten centres were arranged. On good soil no increase in the yield of sugar per acre was brought about by the application of dressings of superphosphate and muriate of potash, whether separately or together. There was no evidence that the use of mineral manures produced any definite effect on the weight of "tops," nor was it possible to associate weight of "tops" with yield of beet. It was observed that the manurial dressings used in these demonstrations exerted a harmful effect on germination—especially on the rate of germination—when the manures and beet seed were sown simultaneously by means of a combined seed and manure drill. It should be noted, however, that smaller dressings—not exceeding 2 cwt. per acre—of phosphatic manures are frequently drilled with the seed in these districts and produce no harmful effect on germination; indeed, they often seem to increase the vigour of the young seedlings.

Variety Trials.—These were conducted at eight fenland centres, but only five produced a crop sufficiently uniform to be reliable. Kuhn P, Dippe E and Kleinwanzleben E were the varieties tested at all centres; Kleinwanzleben Z was also included at three centres and Kleinwanzleben Standard at one centre.

In general, Kleinwanzleben E gave a heavier yield of washed beet per acre than the other varieties. As this variety gave, in most

cases, slightly lower yields of sugar than the others, the yields of sugar per acre were very nearly equal. Kleinwanzleben E was characterized by large and abundant foliage, whereas Kuhn P in general produced less leaf and, where early sowing was adopted, fewer bolters than the other varieties.

The fact must be emphasized that 1928 was a favourable season from the standpoint of sugar formation. In view of this, evidence in favour of a variety which exhibits a tendency to low sugar content must be very carefully examined.

Cambridge :

Bearing on a series of demonstrations on "widths between rows," "ridge v. flat" and "widths between plants," it is remarked that accurate measurements could only be made if a 100 per cent. stand of plants was obtained. There was not a "full" plant at any of the centres and, judging from the results, under ordinary conditions of sugar beet cultivation width between plants is not of first importance.

The results of the "quantity of nitrogen" trials are not very consistent, but on averaging out it would appear that it has paid to apply 2 cwt. per acre of sulphate of ammonia; the economy is doubtful for 3 cwt., while 4 cwt. are definitely too much. In the "time to apply" trials the results confirm those previously obtained, i.e., that there is no advantage in applying nitrogen as a top dressing over applying all of it before drilling the seed. The saving of labour and the avoidance of the top dressing being applied too late make it worth while to apply all the nitrogen at the time of drilling the seed.

As to varieties, the ordinary commercial strain of Kleinwanzleben was grown at five centres, and at another centre the special strains of "E" and "Z" were compared. For the "Z" type a high sugar content with a relatively low yield per acre is claimed, and for the "E" type a low sugar content with a high yield per acre. The results in Cambridge do not fully substantiate these claims.

Kesteven :

On the whole the crops were better than in 1927; not only was the yield higher but the sugar content was distinctly better. Generally, the plants were regular and ranged from 20,000 to 30,000 roots per acre, and there is clear indication of the advantages of getting a good stand, seen both in weight of crop and percentage of sugar, as shown on sections with narrow widths between rows and where intervals of spacing have been kept within narrow limits.

As to manuring, nitrogen in the form of sulphate of ammonia has been an advantage except on the black fen soils.

With regard to varieties, it is thought that, in general, Dippe gave the most bolters this year; Kuhn produced the least amount of tops, but there is no direct evidence that one variety or another is superior in sugar content.

Lindsey :

Seed germinated well, but serious losses occurred through the plants being unable to grow away from the critical seedling stage. On the lighter soils, particularly where farmyard manure had not been applied, the drought of early summer checked growth.

Sugar percentages were distinctly higher than last year.

The result from a "width between rows" demonstration was not conclusive, but general observations and former tests point to the desirability of rows being spaced not less than 19 in. apart. Where narrower spacing is practised and farm horses are used for

inter-cultivation, it is found that many plants are damaged beyond recovery.

A "ridge v. flat" demonstration provided a result in favour of the former—a result quite in keeping with the observations on the growing crop. The "width of singling" trials were again inconclusive, but general observations would suggest as desirable a width of not more than 10 in. For a crop grown on a portion of the ordinary root break of a farm, distances of 19 in. to 20 in. between the rows, with widths of 9 in. to 10 in. between plants in the row, would seem to be indicated.

In the nitrogen trials the results show that the addition of sulphate of ammonia has tended to produce more top and less bottom. The influence on the sugar content appears to be negligible, except on black fen and warp soils, where the sugar content had been depressed. No advantage appears to have been gained by applying the manures in two applications. Other demonstrations have shown that there is still a wide and promising field to cover in the testing of sources of nitrogen other than sulphate of ammonia, muriate of potash, and of the best type and quantity of phosphatic manures to apply under differing conditions.

In the variety trials the performance of Kuhn P must stamp it as a variety of outstanding merit. Marster's was tested at two centres, and in each of these it gave the highest weight of sugar per acre. On a thin wold soil it even gave a better return than Kuhn P.

Notts :

Width between Rows.—Two out of three centres show that the narrower spacings between drill rows have given higher yields. In the wet season of 1927 the wider spacings proved best, whereas in the dry year of 1928 the narrower ones have given better results. This may be explained by the entirely different weather conditions prevailing in the two years.

It is sometimes asserted that the poorer the soil the greater the space which should be allowed to individual plants, i.e., wider drill rows. The 1928 results do not confirm this view, but rather suggest that the reverse is the case, always providing that the crop has received adequate manurial treatment.

The sugar percentage of roots drawn from the 1928 narrow drill row plots proved to be appreciably higher than that of roots on the more widely spaced plots, but such was not always the case in 1927. The number of bolters on the 1928 narrow drilled plots was lower than on the wider plots, but the 1927 results do not confirm this.

Ridge v. Flat.—The general conclusion to be drawn from this demonstration is that flat drilling is safer when suitable implements are available. Ridge drilling, while it may offer some advantages—e.g., in early hoeing—is more subject to harm from drought.

Width between Plants.—The results are in favour of 12-in. spacing in rows 20 in. apart.

Nitrogen Trials.—The "quantity of nitrogen" trials would seem to indicate that a profitable increase in yield of crop may be looked for by an application of one or two top dressings of a quick-acting nitrogenous manure at the rate of about 1 cwt. per acre. If the land is in a high state of fertility or has received liberal dressings of farmyard manure for the beet or previous crop, or if abnormal climatic conditions prevail, it is possible that excess of nitrogen applied by top dressings may not only fail to give a profitable increase of crop, but may be harmful. The results of the "time to apply"

APPENDIX II.—STATEMENT OF AVERAGE WEIGHT OF WASHED

COUNTY	Width between rows			Ridge v. flat			Width between plants			Varieties		
	Centres	Plots	Average weight of washed beet per acre	Centres	Plots	Average weight of washed beet per acre	Centres	Plots	Average weight of washed beet per acre	Centres	Plots	Average weight of washed beet per acre
			Tons			Tons			Tons			Tons
1. Norfolk	7	41	10.52	4	12	11.91	7	21	11.94	7	21	11.09
2. East Suffolk ..	3	11	9.54	—	—	—	1	3	12.80	9	46	12.18
3. Hunts and Ely ..	3	13	15.28	—	—	—	3	8	13.56	7	38	13.64
3A. Cambridge ..	2	4	10.13	2	4	11.14	5	14	9.14	6	30	10.45
5. Kesteven	2	6	12.69	—	—	—	1	3	12.22	8	28	11.57
6. Lindsey	1	3	9.43	1	2	10.32	5	15	11.22	7	29	10.52
7. Notts	3	8	10.17	3	6	9.73	1	3	9.70	2	24	11.62
8. Essex	6	27	9.76	1	2	8.14	1	3	8.14	6	23	9.97
9. Salop	8	23	11.23	—	—	—	—	—	—	—	—	—
10. Yorkshire ..	3	9	8.43	—	—	—	1	3	11.91	3	10	10.07
11. Staffs	—	—	—	—	—	—	3	9	10.84	3	9	10.79
12. Bristol area ..	1	3	13.14	—	—	—	—	—	—	—	—	—
13. Northants ..	—	—	—	—	—	—	—	—	—	1	12	10.09
TOTALS AND AVERAGES	39	148	10.94	11	26	10.25	28	82	11.15	59	270	11.09

N.B.—No allowance has been made for headlands

trials at two centres would seem distinctly in favour of part of the nitrogen being applied before and part after drilling, while at a third centre the result is in favour of the whole being applied before drilling.

Variety Trials.—It is not considered that two years' trials are long enough to emphasize any particular points, except that Kuhn and Johnson stand out as being practically free from bolting.

Waste Lime from Factories.—Arrangements were made to test the influence of the factory waste carbonate of lime on crop yield when compared with an unlimed area, and in some cases with lime from another source. The results at two centres only are considered sufficiently reliable to report; in one case no change was shown in the crop yield, while in the other the crop has responded in a marked degree to both types of lime.

Essex :

On the whole the season was distinctly favourable for sugar beet, and consequently few centres had to be abandoned. Generally speaking, a very regular plant was obtained, but the drought had its effect on crops grown on some of the lighter lands. Singling trials were very difficult to obtain, and still more difficult to carry out with any degree of accuracy.

The results for the most reliable centres appear to indicate that :—

- (1) The heaviest weight of sugar per acre is obtained with 18-in. rows.

T PER ACRE OF EACH TYPE OF DEMONSTRATION IN EACH AREA.

ubsoiling		Use of waste lime			Quantity of nitrogen			Time of applying nitrogen			Quantity of non-nitrogenous manures			Totals and general averages		
Plots	Average weight of washed beet per acre	Centres	Plots	Average weight of washed beet per acre	Centres	Plots	Average weight of washed beet per acre	Centres	Plots	Average weight of washed beet per acre	Centres	Plots	Average weight of washed beet per acre	Centres	Plots	Average weight of washed beet per acre
	Tons			Tons			Tons			Tons			Tons			Tons
10	12.46	-	-	-	6	24	11.12	6	18	11.07	1	4	9.63	38	141	11.04
-	-	-	-	-	3	12	9.87	7	27	12.90	12	51	10.15	38	160	11.41
-	-	-	-	-	2	8	11.82	2	8	10.33	10	45	13.84	27	120	13.08
-	-	-	-	-	5	19	12.01	6	18	9.44	-	-	-	26	89	10.39
-	-	-	-	-	3	12	11.60	2	6	11.90	2	8	11.46	18	63	11.91
-	-	-	-	-	3	12	11.40	4	12	11.75	5	31	12.02	26	104	10.95
-	-	2	4	9.12	3	9	10.95	3	8	10.84	-	-	-	17	62	10.30
-	-	-	-	-	6	28	10.03	6	19	10.02	-	-	-	26	102	9.34
-	-	-	-	-	12	36	10.03	6	18	8.62	-	-	-	26	77	9.96
-	-	-	-	-	6	24	7.34	4	13	7.30	-	-	-	17	59	9.01
-	-	1	2	8.29	-	-	-	3	9	8.82	-	-	-	10	29	9.69
-	-	-	-	-	11	44	12.62	7	22	11.55	-	-	-	19	69	12.44
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	12	10.09
10	12.46	3	6	8.71	60	228	10.80	56	178	10.38	30	139	11.42	289	1087	10.80

and field boundaries in calculating the above yields.

- (2) Kuhn and Kleinwanzleben varieties gave on the whole the most satisfactory results. Dippe gave the highest sugar content but proved very liable to bolt.
- (3) From 2 to 3 cwt. of sulphate of ammonia per acre applied before sowing appeared to give the best results, and no advantage was obtained by applying nitrogenous manures in two dressings.
- (4) The singling trials were unreliable, but indicated that 8-in. singling gave a higher yield than singling at 10 in. or 12 in. when rows were 18 in. apart.
- (5) The results of ridging were inconclusive as regards yield, but there was a definite advantage as far as cleaning operations and lifting were concerned. The dirt tare tended to be lower and the beet larger. This, however, may be mostly due to the wider spacing of the rows.
- (6) Taking the trials as a whole, the heaviest yields were obtained from early sowings, but there was a greater percentage of bolters at the early sown centres.

Salop :

The results in the "widths of rows" trials show that the greatest return is obtained from close drilling. The average results for the two years show that the 18-in. rows give a $6\frac{1}{2}$ per cent. increase over the 21-in. and an 18 per cent. increase over the 24-in. rows. In the "quantity of nitrogen" demonstrations

the results are not very conclusive, but a general inference may be drawn that although the heavier dressings may slightly increase the gross yield, there is a tendency to decrease the sugar content. In general it may be said that the wider apart the rows the poorer the crop, and that for local requirements the width should be from 18 in. to 21 in., according to ease and convenience in cultivating; also that a large dressing of nitrogenous manures, especially where farmyard manure is used, is not an economical practice.

Stafford :

The best distance apart to single beet appears to be 9 in. to 10 in.; this width is better than 7 in. to 8 in. and better still than 11 in. to 12 in. In addition, 9-in. work will be performed more cheaply.

The variety Dippe E appears to be superior in yield to Kleinwanzleben and to Kuhn. Kuhn showed itself free from bolting. In sugar content Dippe and Kuhn are both superior to Kleinwanzleben.

As regards nitrogenous manures, the best result is from an early application. With sulphate of ammonia, a late application would appear to increase the weight of tops and to lower the sugar content.

Yorks :

The results from the "width of rows" demonstrations indicate, as formerly, that the greatest plant population gives the greatest yield. So far, in none of the Yorkshire demonstrations has this plant population reached a number that detrimentally affected the yield of the crop.

A definite increase in yield has been obtained in most cases for increasing amounts of nitrogen up to 3 cwt. of sulphate of ammonia per acre. In the "time to apply" trials the results have not been so definite, but it would appear that no advantage is obtained by omitting nitrogenous manuring entirely until singling.

Worcester : Wiltshire : Somerset : Hereford : Gloucester :

In the "quantity of nitrogen" trials the results obtained in 1928 indicate that sulphate of ammonia, applied at the rate of 1 cwt. per acre, produced a significant increase in the yield of beets and tops without affecting the sugar content. It was noted that applications of sulphate of ammonia in larger quantities produced higher yields of tops but no increase in bulbs, and there was a tendency for the sugar content to be slightly depressed. From the results in the "time to apply" trials it appears preferable to apply the nitrogen at seeding time.

Lime has given striking results where an unlimed strip has been left as a control plot in a field where the soil is definitely acid. In many cases the lime has made all the difference between no crop and a good average yield per acre.

MODERN FRUIT CANNING OPERATIONS

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Research Station, Campden, Glos.

THE canning of English fruits on a commercial scale has made great headway during the past five years, and many of our canning factories are now equipped with the most modern labour-saving machinery. This is in great contrast to the old-fashioned plant, where most of the operations were carried out by hand. The following description of modern canning operations may be of interest to growers, as it shows how rapidly the fruit can be handled, and also gives some idea of the large amount of fruit required to keep a plant working at full capacity.

The canning factory should be situated in close proximity to a fruit-growing area, because such fruits as raspberries and loganberries soon get too soft for canning if they have to be transported long distances by road or rail. At the same time, the factory must, if possible, be near to a railway to facilitate the receipt of raw materials and the dispatch of the finished product. There must also be opportunity for the disposal of waste, whether it be carried away by wash water or, if bulky, be removed by waggon.

A good supply of water is also necessary. Water is used in many ways for canning and it should be of a good drinking quality, free from any suspicion of sewage contamination and low in mineral salts. If very hard water is used for making syrups the latter may become cloudy after the cans are processed. Sulphates and iron salts are specially objectionable.

Preparation of the Fruit.—After the fruit has been weighed in, it is passed on at once to the preparation room. Here the fruit is prepared for the cans. Strawberries have to be plugged, plums stalked, blackcurrants strigged, and the tops and tails removed from gooseberries. The two latter operations are performed by machinery, as is also the peeling of apples. Where the fruit is dirty, it is necessary to wash it, and this operation may be carried out in several ways but the use of water sprays is about the most satisfactory. The sprays are fixed above a travelling conveyor, and the fruit is then carried under the water. Another way is to cause the fruit to roll during the spraying, and a very efficient machine consists of a slightly inclined perforated drum, fitted on the inside with spiral guides, and as the fruit rolls it is thoroughly washed by sprays of water.

Grading.—Before it is filled into the cans, the fruit is carefully graded, and good grading is one of the most important factors in determining the quality of the finished product. The advantages of grading have been recognized by practically all commercial canners, and in good quality canned fruits the pieces are uniform in size and colour. Soft fruits, such as strawberries, loganberries, etc., are always graded by hand, and berries of as near the same size as possible are placed in the cans. Gooseberries, plums and cherries are generally graded by mechanical means, and for this purpose vibrating screens with various-sized openings are often used. The screens are usually three or four in number, and, being interchangeable, one machine can be adjusted for different varieties of fruit.

The cans used in modern canneries are known as sanitary cans (Fig. 1). The ends are not soldered on, as in the old-fashioned can, but require a machine for sealing. The can store is often immediately above the filling room, and the empty cans are carried to the filling tables by overhead run-ways (Fig. 2) from which girls take off the cans for filling with fruit as they are required. As the cans are filled they are placed on a moving belt running down the centre of the table, and they are thus transported to the syruing machine.

Syrup.—In canning, sugar syrup is added to the fruit to improve the flavour, to fill the spaces between the pieces, and to aid the transference of heat during sterilization. Syrup also fills the cans more or less completely, thereby excluding air, the presence of which causes corrosion of the tinplate. The syrup should be made of the best grades of granulated sugar, either cane or beet for both give equal results though tradition often gives preference to the former. The sugar is dissolved in water to give the requisite density of syrup required, and enamel-lined steel tanks (Fig. 3) or copper tanks are generally used for this purpose. The tanks are usually fitted with a steam-heated coil to get the sugar quickly into solution. The syrup is clarified by passing it through thick flannel, muslin, or very fine wire gauze, before being used to fill the cans. In many canneries the syrup preparation room is located on the floor above the canning room, and the syrups are transferred by gravity through pipes to the syruing machines (Fig. 4). The latter are automatic machines which ensure the cans being filled to a definite level each time. As the can enters the syruing machine, it is lifted by the cam action, which raises that

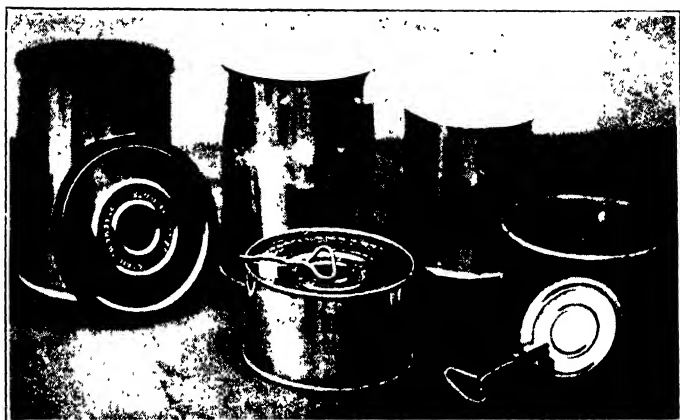


FIG. 1.—Open-ended or Sanitary Cans.

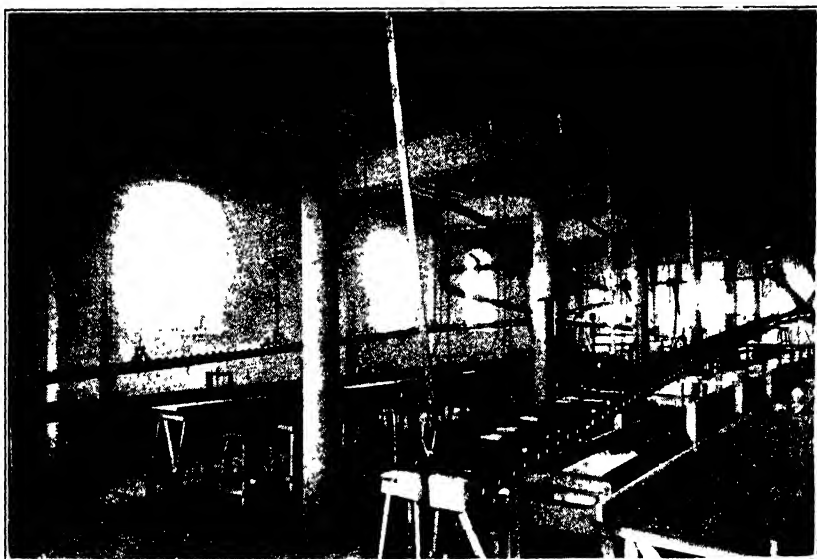
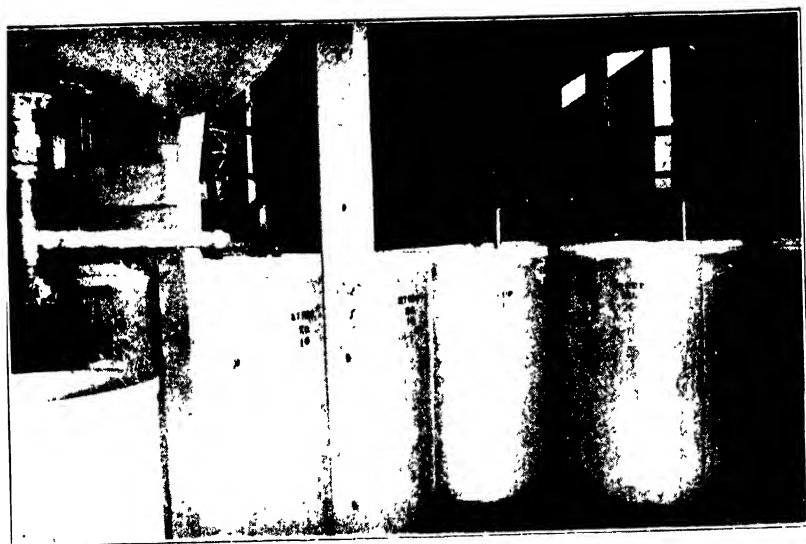


FIG. 2. Canning Tables and Empty Can Conveyors.

[By courtesy of The Cotswold Packing Co, Ltd, Ashchurch.]

MODERN FRUIT CANNING OPERATIONS.



[By courtesy of A. Applegood]

FIG 3.—Syrup Tanks

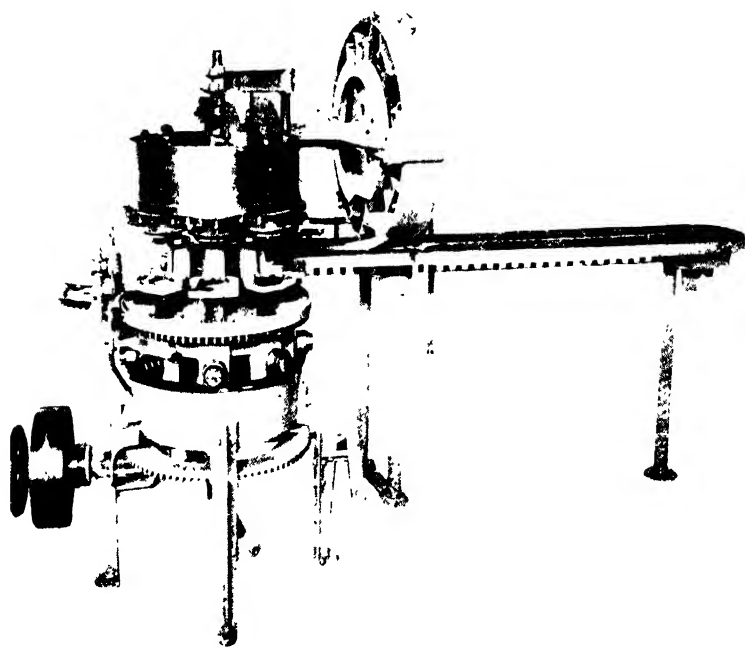


FIG 4.—Syruping Machine.

*[By courtesy of Anderson-Barngrover Manufacturing Co.,
San Jose, California,*

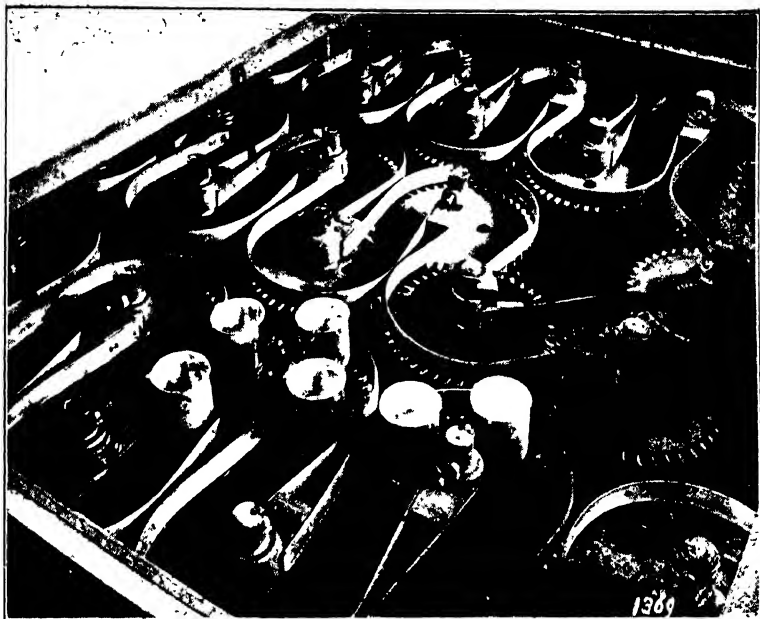


FIG. 5.—Interior of Exhaust Box.

*[By courtesy of Anderson-Barngrover Manufacturing Co.,
San Jose, California.]*

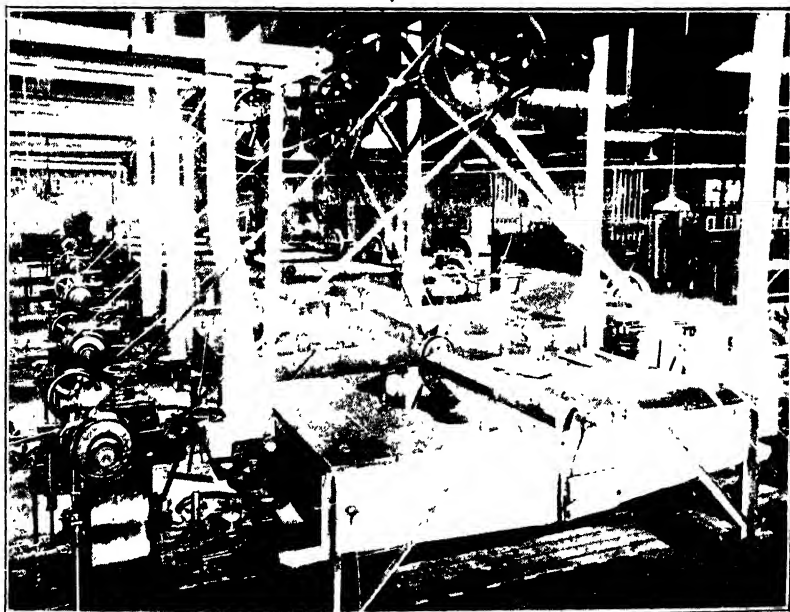


FIG. 6.—Plant in Cooking Room.

*[By courtesy of Anderson-Barngrover Manufacturing Co.,
San Jose, California.]*

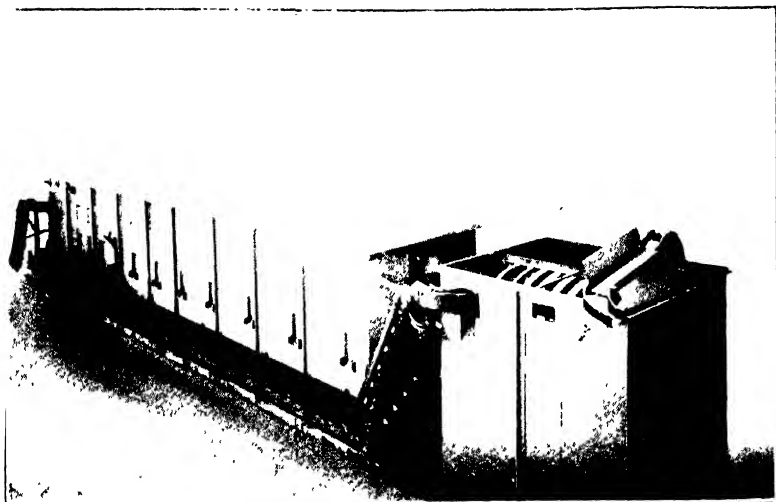


FIG. 8.- Continuous Automatic Cooker.

[By courtesy of Anderson-Barngrover Manufacturing Co.,
San Jose, California.]

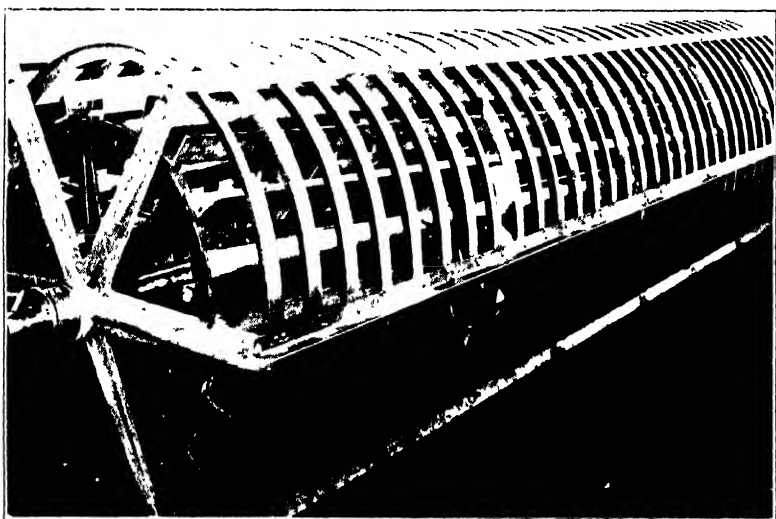


FIG. 9.- Interior of Automatic Cooker.

[By courtesy of Anderson-Barngrover Manufacturing Co.,
San Jose, California.]

portion of the valve body which is slidably mounted, lifting a rubber seal and permitting the inflow of syrup and the outflow of air. When the can is released the valve is forced down by the springs, and seats on the outer portion of the cup, so preventing the backflow of whatever syrup is in the vent pipes—a very important feature and essential to a uniform fill.

Exhaust.—After the cans have been filled with fruit and syrup they pass on through what is known as an exhaust box (Fig. 5), where the contents of the cans are heated by means of steam or hot water. One of the most important objects of exhaust is to remove air from the contents of the can, and thus to reduce corrosion of the tinplate, since corrosion is favoured by the presence of oxygen. The second object is to produce a vacuum so that the ends of the can will be concave, and thus indicate to the prospective purchaser that it is in sound condition. Convex or bulged ends usually indicate gaseous spoilage. Thorough exhausting by heat also tends to prevent over-filling of the cans. A No. 2½ can of fruit should, after sterilization and cooling, show a vacuum of 8 to 15 inches when tested with a can vacuum testing gauge. The vacuum will vary according to the temperature of the can at the time of sealing. The usual exhausting temperature for fruit is 180° F. to 200° F., this range of temperature referring to that of the exhaust box. The temperature of the centre of the can ordinarily reaches 160° to 180° F.

Sealing.—Fig. 6 shows how the cans pass along from the exhaust box to the automatic sealing machine, which spins on the lids. These machines can be obtained to seal as many as 130 cans per minute. The actual sealing is carried out by two small rollers which come into operation one after the other (Fig. 7). The first roller presses the edge of the lid under the lip of the can, and the second roller presses the two together. The machine has a supply of lids, which are placed on the cans automatically. With this type of machine it is only necessary to see that it is well supplied with lids. It is essential, however, that the foreman in charge of the cannery should understand the sealing machine very thoroughly, as unless the cans are efficiently sealed, there will be many blowers and much loss in consequence.

Sterilizing.—As soon as the ends are spun on, the cans pass to the sterilizing plant. The purposes of sterilizing are two-fold : (1) to render the product sterile ; and (2) to improve

the texture, flavour and appearance by cooking. Sterilization should be thorough enough to ensure good keeping quality, and with many canned fruits it is desirable to accomplish this in as short a time as possible, in order that the product may not be over-cooked. Sterilization is usually effected by heating the cans in boiling water, and in modern factories automatic cookers are used. These are known as continuous variable discharge cookers (Fig. 8). In these machines there is a remarkable uniformity of heat penetration, and of the time at which the contents of the cans reach an effective cooking temperature. With these machines, it has been found that all fruits can be safely processed in much less time than is possible with the open tank method, and a more uniform product can be obtained. The length of cook is determined—not by regulating the speed at which the machine is driven, as this always remains the same—but by the door at which the cans are allowed to discharge. When a product which only requires a short cook is being processed, the first or second door is opened, and the cans discharge there, whereas for a longer cook one of the doors further on is opened. Each door corresponds to a definite time, and cans of fruit can thus be cooked for from five to 20 minutes, or longer if necessary.

Fig. 9 shows the interior of one of these cookers. The can-carrying unit is of the reel and spiral type, the outer member being formed in spiral path, and held stationary and in perfect alignment by substantial angle iron which in turn is secured to the tank. The inner member or reel is made to revolve slowly, and it thus pushes the cans along the spiral path, each can in a separate pocket, and all the cans travelling their length with each revolution of the can-carrying reel. In this type of cooker, the cans of fruit are generally cooked for from five to 15 minutes, depending on the size of the can and the variety of the fruit.

Cooling.—After cooking, the cans pass through a similar machine to the above, but this time they are rolled through cold water to cool them rapidly. Cooling plays quite an important part in the appearance of the product. It arrests the cooking, tends to keep the fruit whole, and also helps to keep the colour of the product.

The syruping machine, exhaust box, sealing machine, cooker and cooler, are generally fixed in a straight line, and constitute what is known as a canning line.

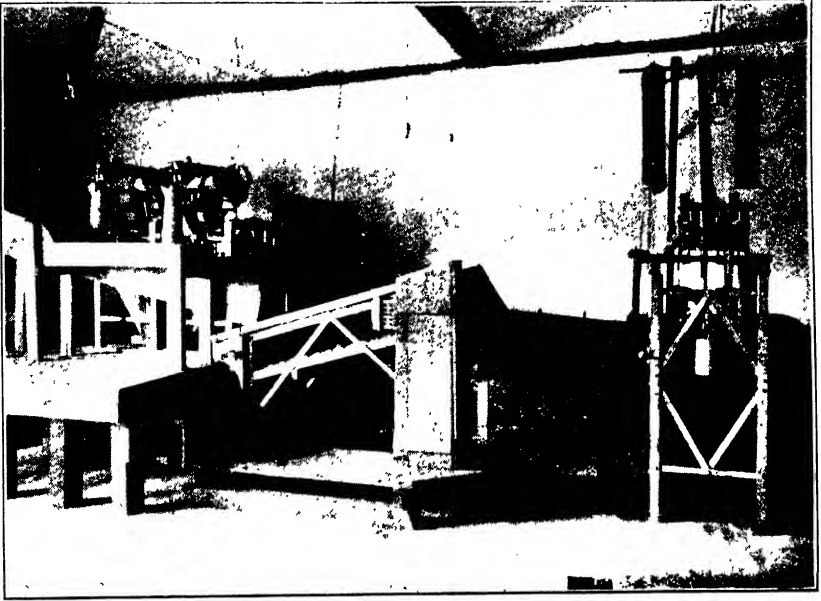


FIG 10.—Machines for Peeling, Coring, and Slicing Apples.

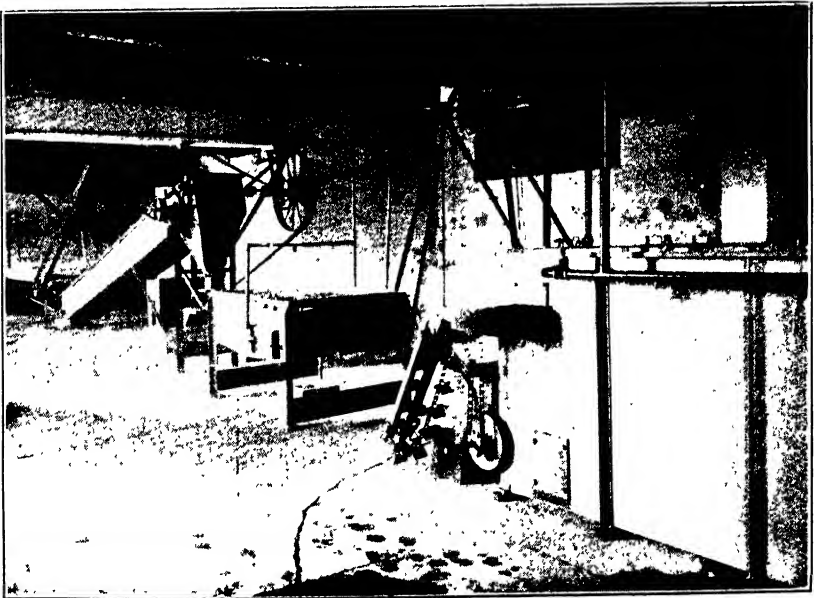


FIG. 11.—Apple Canning Plant, showing Pre-heater, Exhaust Box, and Automatic Cooker.

MODERN FRUIT CANNING OPERATIONS.



FIG. 12.—Boxes of Canned Fruit ready for Distribution.

[By courtesy of The Colson & Park Co., Ltd.]

TIME TABLE FOR PROCESSING FRUITS IN No. 1, No. 2, No. 2½ AND PICNIC CANS.

Fruit		Exhaust	Cook	Size of can
Gooseberries	..	6 min. at 180° F.	8 min. at 212° F	No. 2½
Raspberries	..	6 " " "	7 " " "	No. 2
Loganberries	..	6 " " "	7 " " "	No. 2
Strawberries	..	7 " " "	7 " " "	No. 2
Cherries	..	6 " " 190° F.	15 " " "	No. 2
Currants	..	6 " " 180° F.	9 " " "	No. 2
Plums	..	6 " " "	10 " " "	No. 2½
Damsons	..	6 " " "	10 " " "	No. 2½
Raspberries	..	5 " " "	4 " " "	Picnic
Loganberries	..	5 " " "	5 " " "	Picnic
Currants	..	5 " " "	7 " " "	Picnic
Strawberries	..	6 " " "	6 " " "	No. 1 Tall
Raspberries	..	5 " " "	6 " " "	No. 1 Tall
Loganberries	..	5 " " "	6 " " "	No. 1 Tall
Currants	..	5 " " "	8 " " "	No. 1 Tall
Damsons	..	5 " " "	8 " " "	No. 1 Tall

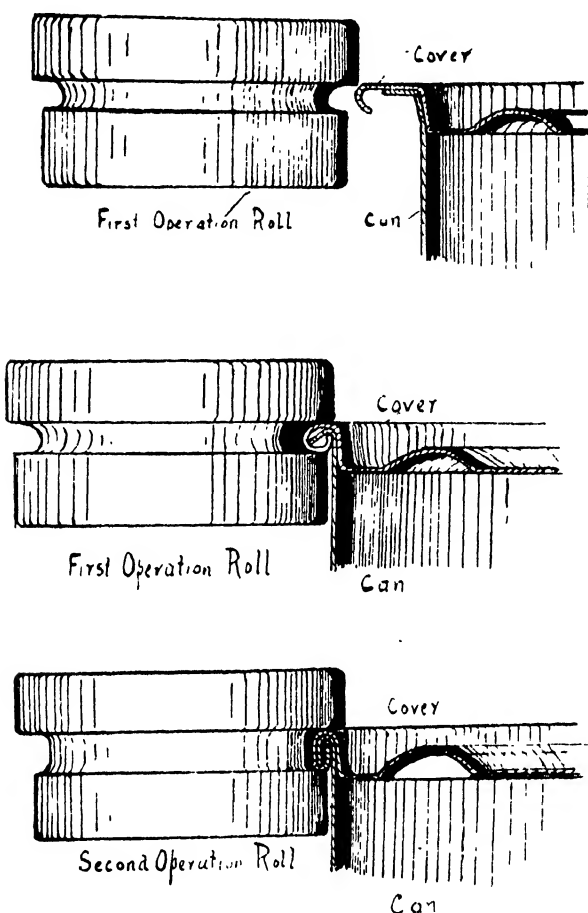


FIG. 7.—*Top*, Position of first operation roller.
Centre, Can and Lid after the first operation.
Bottom, Completion of Sealing the Can.

Solid Pack Apples.—For packing solid pack apples in gallon cans, rather different plant to the above is required. It is necessary to peel, core and quarter the apples, and for this purpose the machine shown in Fig. 10 is used. The apples are pared and cored in the machine shown on the left. The peeled apples then roll down the chute shown on to the roller inspection table, where girls trim off any brown or bruised portions. From the inspection table the apples roll into a box from which a girl picks them out and places them on moving spindles, the spindle fitting in the hole from which the core has been removed. The apples are then carried to the machine on the right of the illustration, which automatically

removes the seed-cells, and cuts the apples into slices. From this machine the apple slices pass down a chute into brine tanks. The brine prevents the action of oxidizing enzymes, which would otherwise cause the apples to turn brown in colour. After brining, the apples are shovelled out on to a conveyor table on which they are sprayed from above by cold water. A girl working at this table removes any brown patches which have been missed previously, and the slices are then conveyed through a steam box or pre-heater. Here the apples are softened by means of steam from a perforated coil, and sprays fixed above the conveyor remove the remainder of the brine. The apples are softened sufficiently to enable them to be packed solid into cans to get a solid pack. From the pre-heater, the apples collect in a hopper, from which they pass out at the bottom into the cans. They next pass through the exhaust box, in the end of which sprays of hot water fill the cans to overflowing. They are then sealed and passed through automatic cookers and coolers, as described previously. Fig. 11 shows the pre-heater, exhaust box and automatic cooker lined up. The sealing machine, which is not shown in the illustration, would fit in between the exhaust box and automatic cooker. The processing times for solid pack apples in No. 10 cans are as follows :—

Preheat	..	..	5 min. at 190° F.
Exhaust	..	..	7 min. at 195° F.
Cook	..	..	20 min. at 212° F.
Cool ..	..	..	5 min.

Packing and Storage.—From the cooler, the cans are conveyed to the store, or packed direct into boxes, and the latter are stacked. During the fruit season, which is a comparatively short one, the canners are kept very busy, and the labelling and packing of the canned fruit is generally left until the canning operations are completed. The labelling is carried out by special machines, and they can be obtained with a capacity of thousands of cans per hour.

With the above type of machinery, the cans of fruit can be sterilized much quicker than when the old method of cooking in open tanks is used. As the cans roll through the cookers, the slight agitation helps the heat to penetrate rapidly to the centre of the can.

The final operation is the packing of cans into boxes for distribution to the retailer (Fig. 12).

STOMACH WORMS IN SHEEP

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THE worms parasitic in the fourth stomach of sheep are a source of great trouble to the sheep farmer, and sometimes lead to very serious loss. Where a severe outbreak occurs it is by no means uncommon for half of the lambs to die, and for the remainder to be so stunted in growth that their market value is greatly reduced; moreover, the ewes may not be altogether safe.

(1) On Pasture Land.—It is on permanent pasture that the disease is usually encountered, and low wet land is generally thought to favour it. Although there may be some truth in this idea, there is no doubt that sheep on the driest of pastures may at times suffer badly. As with all diseases, and particularly with those caused by parasitic worms, overcrowding is an important factor; indeed, the condition of parasitic gastritis in sheep cannot occur without a certain measure of overcrowding. In some parts of the country, farmers have given much attention to the improvement of their grassland by suitable manuring, only to find that, along with its increased sheep-carrying power, stomach worms have become so numerous as to harm the lambs. This state of affairs could not obtain while the poverty of the pasture necessitated the scattering of the sheep.

(2) On Arable Land.—Outbreaks of the disease are not uncommon on arable land in districts where frequent catch-cropping is practised, and where sheep are penned over the same area at short intervals. In one case a loss of £4,000 to £5,000 was sustained during a period of five years' farming under this system, solely due to the ravages of stomach worms. As is shown below, the complete control of this disease is in the hands of the arable sheep farmer if only he is able to make some alteration in his rotation of crops.

The Twisted Wireworm.—There are several kinds of stomach worms occurring in sheep, the commonest being the "twisted wireworm" (*Haemonchus contortus*). This worm (Fig. 1) measures from $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. in length, and is a little thinner than an ordinary pin. In colour it is darker than the wall of the fourth stomach of the sheep, and is tinged with red—due to blood which it has taken from the sheep. The female worm is the larger, and has a twisted appearance owing to the shape of some of its internal parts which show through the skin; it is

tapered towards both ends, and has a small projecting flap about $\frac{1}{4}$ in. from one end. The male worm is smaller, and does not present the twisted appearance or the projecting flap, but at one end carries a comparatively broad membranous portion.

If the fourth stomach (the stomach which is connected directly with the intestine) of an affected sheep be opened soon after death, these worms may be seen moving about in large numbers, and many will be found closely applied to the walls of the stomach. Injury to the sheep is caused by the actual loss of blood, by the irritation of the lining of the stomach (resulting in the derangement of its digestive powers), and by the absorption of a poison which the worms secrete.

The Lesser Stomach Worm.—One other kind of stomach worm warrants special mention: it may be called the “lesser stomach worm of sheep” (*Ostertagia circumcincta*). This worm (Fig. 2) is smaller than the twisted wireworm, and is not easily seen when in its natural position in the contents or on the walls of the fourth stomach. If, however, a small quantity of the stomach contents, or a piece of the stomach wall of an affected sheep be washed in water, these minute worms may be seen like pieces of fine silk in the water, $\frac{1}{4}$ in. to $\frac{1}{2}$ in. in length, and of a dull pink colour. The lesser stomach worm lives in the same position as the twisted wireworm, and affects sheep in the same way.

Distribution.—The two worms described occur in all parts of the world, in sheep, goats and cattle, but are particularly harmful to sheep. They are also responsible, in part at least, for causing land which is heavily grazed with sheep to become what is popularly known as “sheep sick.”

Symptoms.—The first symptoms of stomach worm disease are general unthriftiness, dry appearance of the fleece, and poor condition. In the later stages diarrhoea appears, the animal becomes very thin and bloodless, the membrane on the inner side of the eyelids and lips whitens, and a watery swelling may appear under the jaws. If these symptoms appear, and nothing be done by way of treatment or removal of the lambs from the source of continual reinfection, many of them will die. In severe outbreaks, where worms are exceptionally numerous, some members of the flock may die suddenly, without previously showing the symptoms above described.

Life History.—A short account of the life history of these parasitic worms will greatly assist the direction of intelligent effort towards suitable measures for control.

In their situation in the fourth stomach, the female worms lay large numbers of eggs which reach the ground with the droppings. Under favourable conditions of moisture and temperature on the ground, a minute larval worm develops in the egg, which may hatch within 24 hours from the time it leaves the sheep. The young worm now passes through two stages, from neither of which, however, can it continue its development if swallowed by a sheep. It must complete these stages and reach the third, or "infective larval stage," on the ground, before it is capable of growing to maturity when swallowed. The time taken by the larval worms in passing through the first and second stage to reach the infective stage may vary between three days and several weeks, depending upon conditions of moisture and temperature, dryness and cold delaying their development. Although in this country development would rarely be delayed because of excessive dryness, the temperature is usually well below that best suited to the larvæ, and it can only be in our warmest weather that they reach the infective stage in less than 10 days. This period is of some importance for control measures.

The infective larva is peculiar in being enclosed in two skins, its own and that which it wore during the second larval stage. This loose sheath acts as a protecting covering, and renders the larva very resistant to extremes of heat and cold, to dryness, or such chemical substances as lime and salt. Another, and most unfortunate, attribute of this infective larva is its ability to remain alive for a long period in a field; and although the majority die if they are not eaten by sheep within 12 months, some few may remain alive even longer. This larva is also able to travel in the moisture of the soil, and after having been buried to a depth of six inches may, under favourable conditions, regain the surface in so short a time as seven days. Turning in the contaminated surface with the plough may succeed in finally burying the weaker larvæ but cannot be relied on as a means of prevention. The same power of movement is used in climbing on the herbage in the dew or rain on its surface, where the larva lies in wait to be taken in by the grazing sheep. When this happens the protecting sheath is quickly lost, and the young worm passes through the third and fourth larval stages in the fourth stomach before finally developing into the mature worm. The time which elapses between the swallowing of the infective larval worm by the sheep and the appearance of eggs of the matured worm in the sheep's droppings is three weeks. The

quickest possible time, therefore, for the completion of the life cycle is three weeks and three days, but as the rate of development on the ground may be greatly retarded by unfavourable weather conditions, and the infective larva may rest on the grass for months before it is swallowed by a sheep, the cycle usually takes much longer (*see* Fig. 3).

Prevention and Treatment.—Where outbreaks occur, it is important to know which of the two worms here mentioned is responsible, since there is a satisfactory medicinal treatment for the twisted wireworm, while the lesser stomach worm does not respond to any treatment yet known. For this reason, and also because the condition may be confused with “liver rot,” it is always desirable to call in the assistance of a veterinary surgeon.

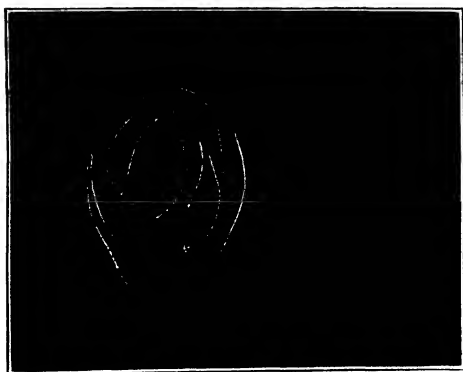
In South Africa the twisted wireworm is an even more serious menace to sheep-rearing than in this country, and a mixture of copper sulphate (bluestone) and arsenious acid (white arsenic) has been used with great success as a cure and control. Copper sulphate is much the more active of the two ingredients and may be used alone, as advocated in America and successfully employed in this country. As the efficiency of the dose is only slightly increased by the addition of arsenious acid, it is advisable to leave such a dangerously poisonous substance to skilled and practised hands.

Copper Sulphate Treatment for Twisted Wireworm.—The treatment with copper sulphate is as follows :—

A solution of pure copper sulphate (bluestone) is made up by dissolving 4 oz. of the pure crystals (which should be of a clear blue colour with no white parts) in $2\frac{1}{2}$ gallons of water in a porcelain or enamel container. This will be sufficient for 100 sheep, and should be given in the following doses :—

Sheep weighing 80 lb. or over	..	..	4 fluid ounces
Lambs weighing 70 lb.	..	..	$3\frac{1}{2}$ „ „
Lambs weighing 60 lb.	..	..	3 „ „

The preparation of the solution may be hastened by dissolving the bluestone in a little hot water and bringing the quantity up to $2\frac{1}{2}$ gallons afterwards. The best way to administer the dose is by means of a metal funnel leading through a joining portion of rubber tube to a short metal tube ; the sheep is held in a standing position with the metal tube in its mouth by one man, while another holds the funnel and slowly pours in the measured dose. Some little danger attaches to this proceeding if carelessly done, through overdosing or entering of the



1.

2.

FIG. 1.—The Twisted Wireworm (*Haemonchus contortus*). Nat. size.

FIG. 2. The Lesser Stomach Worm (*Ostertagia circumcincta*). Nat. size.

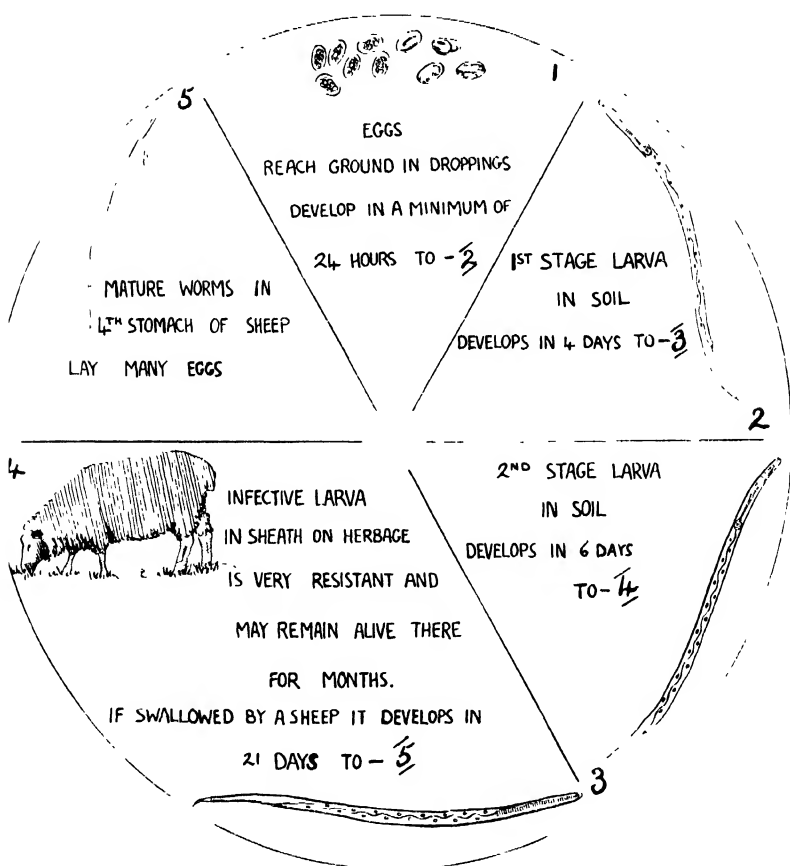


FIG. 3.— Life history of the stomach worm of sheep, showing various stages of its development, and the duration of each stage under favourable conditions on the ground.

solution into the lung, and it is more satisfactory to have proper veterinary supervision at hand.

A fast of 12 hours before dosing, and of five hours afterwards, renders the treatment much more effective, but this measure is not altogether necessary and, if the sheep are already in a weak condition, may not be desirable.

If sheep are thriving badly, and some of the lambs are beginning to show signs of diarrhoea and becoming very weak, it is advisable not to wait for one to die, but to kill the weakest in order to make an examination of the fourth stomach for worms. As soon as the cause of the disease has been ascertained through the discovery of the worms, the whole flock should be treated with the solution of bluestone as above described. Farmers whose sheep are frequently troubled with the twisted wireworm should not wait for symptoms of the disease to appear, but should dose all the sheep in the spring, and continue with regular dosings at intervals of three or four weeks throughout the summer. Ewes which are heavily in lamb and lambs less than six weeks old should not be treated.

Control of Lesser Stomach Worm.—Where the disease is due to the lesser stomach worm, control must depend solely upon the arrangement of grazing in such a manner that the opportunity for lambs to pick up infection is reduced to a minimum. The parasitic worms of the fourth stomach of sheep are so common that they are regarded as almost normal inhabitants, and it is only when conditions are greatly in their favour that they occur in such large numbers as to do harm; a little weight thrown into the balance for or against the worms may decide whether they will become very numerous and get the upper hand, or whether the lambs will come through the summer unharmed.

Penning on Root or Forage Crops.—The arable farmer who pens his ewes and lambs on roots or vetches has the complete control of this disease in his own hands. The usual practice on such farms is to move the sheep on to fresh ground every day, or every other day, and it will be readily understood from the short account of the life history given above that under those conditions lambs could not possibly become infected, even though penned with heavily infected ewes. (Two days is not sufficient time for the eggs dropped by the ewes to have reached a stage in which sheep can be infected.) Nevertheless, this system of penning does not prevent the occurrence of severe outbreaks, which may always be traced to the penning of sheep

over the same ground within the previous 12 months. The minute larval worms from the previous folding have reached the infective stage and have not been left long enough to die of starvation.

Outbreaks of disease do not always occur when this practice is followed, because conditions of temperature and moisture may not have been the best possible for the development of the larval worms on the ground. If, however, land on which sheep are penned for one or two days at a time could afterwards be kept free from sheep for a period of at least 12 months the disease could not occur. The final outbreak is produced in the following way: Sheep which carry a few worms are penned over a field and pass thousands of eggs on to the ground with their droppings. If sheep are penned over this same ground again within 12 months they will pick up thousands of infective larvæ which will mature, and tens of thousands of eggs will be passed with the sheep's droppings. There still may not be a sufficiently large number of worms present to cause serious disease, but if sheep go over that same ground a third time after an interval of less than twelve months, and if the conditions of moisture and temperature have been suitable for larval development, hundreds of thousands of infective larvæ will be picked up and the sheep will suffer from parasitic gastritis.

This kind of outbreak occurs in parts of the country where the Wiltshire rotation, or some modification of that rotation such as the following is practised: *Rye, Winter Barley or Vetches* grazed off by sheep in May, June and July is followed by *rape and turnips*. If this crop is planted early enough it may be grazed off during the same year; if not it is grazed off during the early spring of the following year and another crop of *rape and turnips* is put in during May or early June. This crop is grazed off in the summer or autumn and is followed by *wheat*. After the wheat comes another *straw crop*, then *clover*, and finally a *straw crop* to complete the rotation.

Under this system of cropping the sheep are penned over the same ground twice in a period of six months, and three times in little more than 12 months. In the crowded conditions of a pen of sheep on a green crop the mixture of droppings and moist earth resulting from the thorough trampling forms an ideal place for the young stomach worms to develop. If this system of frequent penning is continued, stomach worm trouble is almost certain to arise at a time when the sum total of conditions in favour of the worms

happens to be just a little better than usual. Wherever possible, and particularly where such outbreaks have occurred before, it would be advisable to make such alterations in the system of farming as will ensure an interval of at least 12 months between two penning of sheep over the same ground.

Although this may necessitate a little reduction in the number of sheep kept it would be worth consideration where the risk of parasitic gastritis in the sheep is great.

The disease could be controlled with certainty by some such modification of the old five-course rotation as the following : (1) *Roots*, (2) *Straw crop*, (3) "*Seeds*" or *Sainfoin* (cut for hay), (4) "*Seeds*" or *Sainfoin* (grazed), (5) *Straw crop*, (6) *Straw crop*, (7) *Roots or Green Forage*, (8) *Straw crop*. Sheep would then only go over the land on the first, fourth, and seventh years and the stomach worms could not possibly get the upper hand under such conditions.

Prevention of Straying of Lambs.—Another source of some infection in lambs on arable land may be mentioned. The hurdles used for the pens frequently allow exit to lambs, which are then able to graze the young herbage springing up on ground which has been occupied by the flock some days or weeks previously, and in this way they pick up a few worms. Although the infection resulting from such grazing is not likely to be a heavy one, it is advisable to avoid it by preventing the straying of the lambs.

Control on Grassland.—Control on grassland is not so easy a matter to prescribe for, and must depend upon careful management of the grazing, particularly where the pasture is rich and will carry as many as four or five sheep to the acre. Although it is not applicable to all districts, it is a wise precaution to have a forage crop on which to keep the ewes and lambs during the early part of the summer. Where this is not practicable, an attempt should always be made to reserve some clean pasture for the ewes and lambs, and to put them on ground where there have been no sheep for a period of 12 months.

Summary of Important Points.—(1) Stomach worms are exceedingly common in sheep, but they cause harm only when present in large numbers.

(2) Overcrowding shortens the life cycle, as the young worm in the soil has a better chance of a speedy return to the sheep. A little better spacing of the sheep may make all the difference.

(3) Worms do not multiply in the sheep or lambs ; every

worm present in them must have been picked off the ground with the herbage.

(4) One sheep cannot be infected from the droppings of another until such droppings have been on the ground for a time rarely less than 10 days, and usually longer. Hence, infection picked up by lambs penned for two days at a time over different parts of a root field must have come from a previous grazing.

(5) Penning sheep over arable land more frequently than once in 12 months is dangerous, as many larval worms may be ready to infect the second lot of sheep. Many more will be ready to infect a third lot of sheep penned over the same ground within too short an interval, and if conditions have been exceptionally favourable to their development the larvæ may be sufficiently numerous to cause disease.

(6) The young worms on the ground are very resistant to lime, salt, poisonous chemical substances (as bluestone or green vitriol) and adverse weather conditions.

(7) The young worms may remain alive on the ground for a long period, but the great majority will have died in a field kept free from sheep for 12 months.

(8) Sheep parasitized by the twisted wireworm may be beneficially treated by dosing them with bluestone as directed. This treatment has no effect upon the lesser stomach worm.

Summary of Preventive Measures.—(1) Overcrowding should be avoided, ewes and lambs should be placed on pasture which has been free from sheep for 12 months.

(2) A root or forage crop should be grown on clean land for the ewes and lambs to graze off in the spring and early summer.

(3) Where penning sheep on root and forage crops is largely practised, running them over the same ground twice within 12 months should be avoided.

(4) If sheep must be penned over the same ground twice within 12 months, the second crop should be eaten off by old sheep only, because of their greater resistance, the ewes and lambs being put on to clean ground.

(5) In penning sheep on arable land, wire netting, or hurdles of such a pattern as will prevent the lambs from straying back to contaminated ground, should be used.

(6) If sheep are known to be affected with the twisted wireworm they should be treated with copper sulphate; and on farms where disease frequently occurs because of this parasite, treatment should be given at intervals of three or four weeks during the spring and summer.

COST ACCOUNTS ON AN INSTITUTE FARM

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IN 1920 the Hertfordshire County Council purchased an estate of 300 acres to serve as a centre for agricultural education in the County. The mansion house was reconstructed to meet the requirements of a residential Farm Institute, and the land has been utilized to provide accommodation for the farm, the gardens, and the poultry department, all of which are run on commercial lines.

Cost accounts have been kept on the Institute farm since 1923, and articles dealing with the costs of horse labour, grassland, etc., have been issued from time to time, while complete and detailed cost records for four years have been published in a Bulletin.* The present article aims at presenting a general summary of the financial results over the four-year period 1923-26, and readers are referred to the Bulletin itself for fuller details.

Description of the Farm.—The farm extends to 222 acres, two-thirds being arable. The soil varies not only from field to field but often to a marked extent within the same field. It is generally of a sticky clay nature, with a large number of flints, but there are considerable areas of light gravel. To a large extent this is typical of the poorer soils in Hertfordshire.

The basis of cropping is the five-course rotation. The selling crops are potatoes, wheat, barley, and in the last year of the period now reviewed (1926) sugar beet. All other crops are fed to stock.

A herd of about 20 dairy cows is kept—all non-pedigree dairy shorthorns. The herd is maintained partly by introducing home-bred heifers from good milking cows and partly by purchase. Steer calves are fattened for baby beef production. A breeding stock of pigs is kept for the production of pork. All fat pigs are disposed of direct to local butchers. A flock of ewes of various breeds is carried and crossed with a Suffolk ram for early lamb production. Poultry are not kept under farm conditions, but as a distinct unit. The working horses number six, exclusive of a light odd horse.

The regular farm staff numbers nine, including the bailiff, and casual labour is employed from time to time as required.

* Bulletin No. 4, Herts Institute of Agriculture, Oaklands, St. Albans, December 31, 1927.

Capital.—The capital† employed and shown as tenant's capital in the balance sheet is set out in the following table :—

Year				Capital			Capital per acre		
				£	s.	d.	£	s.	d.
1923-4	..	..	..	*6250	0	0	*27	14	4
1924-5	..	..	..	6262	4	0	28	4	2
1925-6	..	..	..	6310	1	0	28	8	6
1926-7	..	..	..	6890	9	4	31	0	9

† Capital includes stock and cash in hand and balances of debts outstanding. * Estimated.

The capitalization per acre is very much greater than the normal for similar farms. (The most recent reports from the School of Agriculture, Cambridge, give the average capital per acre on 13 East Anglian farms at £16 14s. 0d., with extremes of £7 6s. 9d. and £26 14s. 3d.) Although adequate capital is necessary for farming operations, a high capitalization may lead to very heavy annual charges in certain departments. The high capitalization of the Institute Farm, as shown above, is largely due to the high proportion of capital accounted for by implements.

Manual, Horse, and Tractor Labour.—The cost of manual labour has varied from £4 4s. 6d. to £5 5s. 6d. per acre, per annum, during the four years. The latter figure was the cost in 1926 when a considerable amount of extra fencing and draining was done, and when there was a larger head of pigs and young stock. (The average outgoings for labour on the farms costed by the School of Agriculture, Cambridge, are £4 0s. 9d., with extremes of £3 8s. 5d. and £5 11s. 10½d.)

The cost of keeping a farm horse for a year has been just over £36, and the cost per horse-hour worked has varied from 5d. to 6d.

Tractor costs have varied from 2s. 10d. to 4s. per hour. The work done by the tractor includes the usual tillage operations, thrashing, and driving other stationary machinery.

Grazing Costs.—The average cost of the maintenance of grassland has been approximately £2 5s. 6d. per acre. Records are kept of the number of days each class of stock grazes and, from the information thus obtained, it is possible to arrive at the cost of grazing individual animals. The average cost over the four years has been £4 6s. 6d. per cow, £2 13s. 3d. per horse, and £1 0s. 8d. per ewe.

Cereal Costs.—In the space available, it is obviously impossible to do more than note one or two of the main facts which have emerged. Wheat has been grown after both "seeds" and roots, and the cost per cwt. after the latter

crop is very much higher. This is mainly due to the charge for the residual value of the dung applied to the root crop. Further, in the same year, there has been marked variation between the yields from different fields. One field on the farm, assessed by the eye to be a poor one, has consistently confirmed that view by growing all types of crops at a relatively high cost. The figures relating to barley are of interest in that in three seasons (and incidentally 1927) a more reasonable figure was obtained for Spratt Archer barley sown in the autumn. Autumn-sown oats have generally been produced at a reasonably low cost.

The following table shows the average cost per acre, yield, and cost per cwt., with the extremes, for the three cereal crops :—

	WHEAT	BARLEY	OATS
Cost per acre	£8 7 6 (£6 8 8 to £10 0 6)	£10 1 7 (£6 5 1 to £11 13 1)	£8 1 2 (£5 17 1 to £9 11 7)
Yield of grain (cwt.)	14½ (13½ to 16½)	14½ (10 to 22½)	16 (9½ to 21)
Cost per cwt.	9/9 (7/8 to 11/8)	12/3 (8/5 to 17/4)	8/7 (6/1 to 11/10)

It will be seen that the cost of growing wheat and barley is, on the whole, high. This is due mainly to relatively low yields, for the actual costs per acre do not vary much from year to year. It appears, therefore, that the most hopeful approach towards a reduction in the cost of cereals is to endeavour by means of manuring, new varieties, etc., to raise the yield per acre, although the natural infertility of the soil will always tend to act as a limiting factor.

Root Crops.—Roots—mangolds, marrow-stem kale, cabbage, swedes—have always proved expensive crops despite the fact that the average yields per acre correspond closely with the averages for England and Wales. Invariably there has been promise of good yields, but the tendency to over-estimate yields, which appears common among farmers, has been effectively corrected by the weighbridge.

Costs per acre, yield, and cost per ton of roots are as follows :—

	1923	1924	1925	1926	Average
Cost per acre	£18 7 0	£20 13 5	£19 7 4	£22 12 0	£20 5 5
Yield in tons	16	19½	18	22	19
Cost pr.tn. (in clm.)	£1 2 11	£1 1 2	£1 1 6	£1 0 7	£1 1 4

Potatoes.—The average cost of growing potatoes has been £5 12s. 2d. per ton, and the average yield 6 tons 9 cwt. per acre. Except in 1925, there has been a profit on potatoes.

Silage.—This crop has been produced at a relatively cheap cost each year. The cost per ton (green stuff) delivered at the silo has averaged 20s. Allowing for shrinkage, depreciation on silo, cutter and blower, etc., the cost per ton *fed* has averaged 27s. The silage costs have, therefore, compared very favourably with those for roots, and not unfavourably with those for hay. The average yield per acre of green stuff has been $7\frac{1}{2}$ tons.

Milk Production.—The average cost of keeping a cow for a year comes to approximately £37, and, over the four years, the average cost per gallon of milk produced under "Certified" conditions has been 13·7d. Of this sum 9·9d., or 72 per cent. of the total, was accounted for by the cost of home-grown and purchased foods and the upkeep of grazing. Labour amounted to 3·4d. per gallon. Delivery costs are not included in these figures. The cost per gallon produced has steadily decreased from 16·7d. in 1924 to 11·6d. in 1926.

Beef Production.—Baby beef production at the Institute has been fully described in previous issues of this JOURNAL,* and the cost figures are certainly very suggestive. With steers from a herd of dairy shorthorns, sired by a dairy bull, it has been possible to produce beef at an average cost of 57s. per cwt., and to sell it at an average of 64s. per cwt.

Pigs.—Wessex, Large Black, and Middle White sows, crossed with a Middle White boar, are used for pork production. There is a good local demand for pigs weighing about 120 lb., and the average live weight of the pigs sold over the four years has been 125 lb., with an average dead weight of 83 lb. The cost of production per 8-lb. stone dead weight was 12s. in 1923, 8s. in 1924, 7s. in 1925, and 5s. 8d. in 1926.

Sheep.—Lambs are sold fat direct off the ewes, and the cost of production per 8 lb. dead weight has been 7s. 3d., 10s. 2d., and 10s. 11d. in 1924, 1925, and 1926 respectively.

Income and Returns.—The following table shows the total sales in each year, the percentage turnover in relation to capital, the net profit, and the return per cent. on capital:—

Year	Total sales	Turnover	Net profit*	Return p.c.
	£ s. d.		£ s. d.	
1923-24 ..	3,378 3 11	..	61 17 9	..
1924-25 ..	3,114 6 10	49·7	267 13 0	4·3
1925-26 ..	3,331 13 4	52·8	402 2 7	6·4
1926-27 ..	3,618 14 2	52·5	631 7 7	9·2

* Out of the profit the farmer has to provide his own remuneration and the interest on his capital.

* This JOURNAL, December, 1925, p. 779 ; and November, 1928, p. 722.

The profit in 1924-25 is arrived at after charging a bad debt of £134 10s. 0d., which reduced the percentage profit from 6.4 to 4.3. The amount of tenant's capital, on which the above calculations are based, is given on page 40.

The incidence of profits and losses is shown in the following table :—

Account	1923	1924	1925	1926
Cattle ..	— 23	— 17	— 9	— 92
Dairy herd ..	..	+ 112	+ 307	+ 341
Pigs ..	— 192	— 25	+ 77	+ 311
Sheep ..	— 5	+ 118	+ 65	+ 37
Wheat ..	+ 10	+ 115	+ 61	+ 8
Potatoes ..	+ 241	+ 70	— 103	+ 14
Barley ..	— 24	+ 21	..	+ 30
Other crops ..	— 8	+ 8	+ 4	— 18
Bad debts ..	..	— 134	..	..
Net totals ..	— 1	+ 268	+ 402	+ 631

SUMMARY.

Arable land ..	+ 219	+ 80	— 38	+ 34
Live stock ..	— 220	+ 188	+ 448	+ 597
Net totals ..	— 1	+ 268	+ 402	+ 631

No separate details are available for the dairy herd in 1923.

Apart from 1923-24 when, heavy charges were incurred in establishing the herd, milk production has proved the mainstay of the farm. Sheep and wheat have also been fairly stable factors. It is in pigs and potatoes that the greatest variation occurs, and an examination of the above figures will show to what extent the profits or losses on these two accounts affect the profits or losses from the farm as a whole.

The following table shows the value of produce grown on the land:—

	1923-4	per cent.	1924-5	per cent.	1925-6	per cent.	1926-7	per cent.	Average	per cent.
	£		£		£		£		£	
Arable produce sold and transferred ..	677	39	752	50.	784	42	949	50	790	45
Arable & grazing produce charged to live stock ..	1,069	61	745	50	1,062	58	927	50	951	55
Total ..	1,746	100	1,497	100	1,846	100	1,876	100	1,741	100

The following table analyses the income :—

	1923-4	per cent.	1924-5	per cent.	1925-6	per cent.	1926-7	per cent.	Aver- age	per cent.
	£		£		£		£		£	
Arable produce sold ..	563	18	458	15	598	18	723	20	586	17
Do. transferred	114	3	294	9	186	6	226	6	205	6
Value of work done for other Departments	47	1	79	3	88	3	172	5	96	3
Live stock sales	2,654	78	2,283	73	2,459	73	2,497	69	2,473	74*
Total ..	3,378	100	3,114	100	3,331	100	3,618	100	3,360	100

* This figure, which is exclusive of poultry sales, is of special interest in view of the situation of the farm and of the figure of 68 per cent. given as the percentage of sales from all farms in England and Wales in the Report on the Agricultural Output of England and Wales, 1925.

The figures here are, as regards arable land, startling. The profit or loss *per acre* from selling crops in the four years were : 1923, a profit of 19s. 7d. ; 1924, a profit of 7s. 3d. ; 1925, a loss of 3s. 5d. ; 1926, a profit of 3s. 1d. Such figures give no margin to meet interest on capital, living expenses, or recompense for management. Live stock has proved the most reliable source of income, and it is certainly suggestive that, on a farm two-thirds of which is arable, 74 per cent. of the total sales are from live stock.

The outstanding inference from the results obtained may be stated as follows :—

On a farm with poor variable soil it would appear to be possible substantially to increase the returns from live stock. Equivalent energy and the application of the best known methods of cultivation, manuring, etc., have failed to influence to any material extent the output per acre from the arable land.

This, therefore, remains the main problem requiring solution at Oaklands and probably also on much of the inferior arable land in England. During the next few years it is intended to make further efforts towards the solution of this widespread problem.

SUCCESSFUL CONTROL OF APPLE SCAB IN THE WISBECH AREA

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and

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THE incidence of Apple Scab in the Wisbech district is now one of the most important factors in the profit and loss of apple growing. Although various workers have shown that this disease can be economically controlled by spraying with home-made Bordeaux mixtures or with lime-sulphur solution, it was felt that the results of spraying for three consecutive years would carry greater conviction than those from one year's work only. Accordingly a three years' spraying programme was arranged. At present only a part (two years) of this programme has been carried out ; but, as the results show why many plantings of Worcester Pearmain become unprofitable in the Wisbech district after the trees reach a certain age, it has been suggested that the results are already of sufficient interest to warrant publication.

A plantation of rather large trees of the variety mentioned, cultivated by Mr. A. Shuker,* North Brink, Wisbech, was selected for the experiments. The trees, about 21 years old, averaging 18 to 19 ft. high and 20 ft. spread, were on grassland. The distance apart was 24 ft. by 22 ft. ; each row contained four trees and each plot consisted of two rows. The ground sloped slightly upwards from Plot 1 to Plot 11, and the soil (a medium silt) was lighter at this upper end. There was very little apple capsid damage on the trees.

The Spraying.—Two barrow-type, hand-power machines, each with one lance (bent at the nozzle), were used, and the nozzles were adjusted to give a fine, mist-like spray. The spray fluids used were lime-sulphur and Bordeaux mixtures, one of the latter made on the excess lime formula, 10 : 3 : 40, and the other of half this strength. Since it is usual in commercial practice to add arsenate of lead to fungicides in order to give insecticidal value to them and thus reduce the number of spraying operations, 5 lb. of lead arsenate paste were added per 100 gallons of the lime-sulphur solution and the Bordeaux spray mixtures.

* Hearty thanks are due to Mr. Shuker for the exceptional facilities provided and for the very keen interest he took in the experiments.

For the first or pre-blossom application lime-sulphur was used at a strength of 1 in 30, or $1\frac{1}{2}$ gallons in a 40-gallon tub ; after blossoming the strength used was 1 in 60, or $\frac{2}{3}$ gallon per 40-gallon tub. Arsenate of lead paste, at the rate of 2 lb. per 40 gallons, was added just before use. For preparing the Bordeaux mixtures, a stock solution of copper sulphate at the rate of 1 lb. to 1 gallon of water was made by placing the copper sulphate in a bag and suspending it in the water overnight. For a 40-gallon tub of Bordeaux mixture, of the 10:3:40 formula, 10 lb. of fresh, unslaked quicklime (Buxton) were gradually slaked in a bucket covered by a bag to retain the heat generated in slaking. When the lime was thoroughly slaked to a fine powder, water was added and the mixture was rubbed into a creamy fluid. More water was then added to make a milky liquid, which was strained through sacking into a tub containing about 30 gallons of water, in which sufficient space was left for the addition of 3 gallons of the copper sulphate solution, and for a further addition of 2 lb. of arsenate of lead paste, the whole being made up to 40 gallons. For the weak excess-lime-Bordeaux, half the above quantities of lime and copper sulphate was used.

The actual spraying operations were carried out by Messrs. Kent and Shuker and were done in exemplary fashion ; and here it is considered of importance to lay emphasis on the correct method of applying a fungicide. *In applying a fungicide the object should be to cover every part of the branches, foliage and fruit, with fine particles of the spray fluid, without causing them to run together and drip. For this purpose it is necessary to keep the nozzle continually on the move about 2 to 3 ft. from the branch actually being sprayed, and to point the nozzle mainly upwards so that both surfaces of the leaves become covered.*

Results in 1927.—All the trees were sprayed during the winter with a 10 per cent. tar-oil wash. In the spring, the first spraying against Scab was done on May 2, when the pink colour of the blossoms was showing. The second spraying took place on May 23 after the fruit had set. No injury of economic significance was noticed on any of the trees as the result of spraying. The crop was a fairly good one, the sprayed plots yielding nearly 1 cwt. per tree. The coloured apples were picked at the beginning of September, and the bulk during the period September 20-27. The fruit was sorted carefully into the following grades : (a) Free from Scab, (b) showing slight Scab spots, the total scabbed area being less

than could be covered by a sixpence; and (c) badly scabbed, and seriously affected in market value.

The results obtained are shown in Table I, in which the arrangement of the plots and the distribution of the unsprayed trees are also shown. It will be noticed that each sprayed plot was next to an unsprayed one. To Plots 1 and 11 (not included in the table) was applied a Bordeaux spray made up by mixing a commercial powder with the requisite amount of water. The results of this are mentioned later.

TABLE I.

Plot Rows No.	Spray fluid	No. of Trees	Percentage weight of Apples			Average crop per tree lb.
			Clean	Slightly scabbed	Badly scabbed	
2 3-4	Bordeaux 5 : 1½ : 40 + Lead Arsenate	8	40	50	10	78
3 5-6	Control (unsprayed)	8	0.2	6	94	63
4 7-8	Bordeaux 10 : 3 : 40 + Lead Arsenate	8	50	41	9	94
5 9-10	Lime-sulphur + Lead Arsenate	7½*	10	44	46	114½
6 11-12	Control	7	0.1	5	95	56
7 13-14	Bordeaux 10 : 3 : 40 + Lead Arsenate	8	47	43	10	121
8 15-16	Bordeaux 5 : 1½ : 40 % Lead Arsenate	8	30	54	16	131
9 17-18	Control	8	0.3	10	90	51
10 19-20	Lime-sulphur + Lead Arsenate	7	3	43	54	123½

* One tree was about one-third the average size.

The average results for each treatment are shown in Table II.

TABLE II.

Spray fluid	No. of trees	Percentage weight of Apples			Average crop per tree lb.
		Clean	Slightly scabbed	Badly scabbed	
Bordeaux 10 : 3 : 40 + Lead Arsenate	.. 16	48	42	9	107
Bordeaux 5 : 1½ : 40 + Lead Arsenate	.. 16	33	53	14	104
Lime-sulphur .. 1 in 30 and 1 in 60 + Lead Arsenate	.. 14½	6	44	50	119
Control .. ..	.. 23	0.2	7	93	57

The control plots, with 93 per cent. of badly scabbed apples, show the serious amount of the disease present. The best result was obtained by the use of Bordeaux mixture 10 : 3 : 40, for the crop was almost doubled and only 9 per cent. were badly scabbed, whilst even these were of more value than apples of a similar grade from the unsprayed trees. The

slightly scabbed apples from the sprayed plots were also a better sample than those in the corresponding grade from the control trees. The gain in *clean* apples from the use of Bordeaux mixture 10 : 3 : 40 amounted to nearly 2 tons per acre ; and that of *marketable* apples was over 3 tons per acre. The half-strength Bordeaux gave the next best result, and, under the given conditions, was superior to lime-sulphur.

At the beginning of July, the trees sprayed with lime-sulphur seemed to be as good as those sprayed with Bordeaux, but the effect of lime-sulphur did not appear to be so lasting. From the results obtained we decided to make three applications of all the sprays in 1928.

Results in 1928.—The spraying operations were exactly similar to those of 1927 with the addition of a third application on June 15, similar in all respects to the second application.

The dates of application were as follows :—

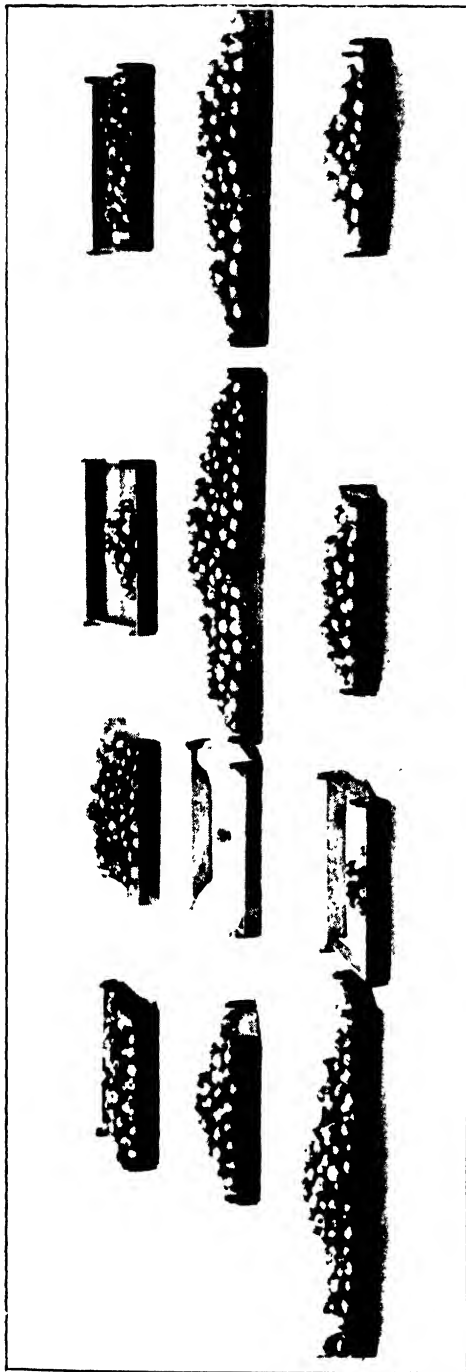
- 1st spraying (pink stage) May 1. (About 25 per cent. of the central flowers had expanded.)
- 2nd spraying (after blossoming) May 21.
- 3rd „ June 15.

The weather conditions on the dates of spraying, and on the day immediately succeeding each spraying day, are indicated in the following records taken within a mile of the orchard. Rain measuring 0.11 inch fell on the day of the third application, but not until some three hours after the work had been completed, by which time the spray fluids had dried on the trees.

AIR TEMPERATURES IN SCREEN, ° F.

Date	10 a.m.	4 p.m.	Maximum	Rainfall, inches in 24 hrs.	Bright sunshine, hours
May 2 ..	50.6	48.9	55	.01	0.1
„ 3 ..	58.8	52.7	69	nil	7.8
„ 21 ..	50.9	47.7	55	Trace	2.1
„ 22 ..	47.7	44.5	50	.13	nil
June 15 ..	54.5	47.1	61	.11	10.8
„ 16 ..	51.3	46.1	57	.03	10.6

The fruit on the 10 : 3 : 40 Bordeaux plots was slightly russetted, and there was a slight leaf fall after the third spraying (noted on July 6). The fruit from the 5 : 1½ : 40 Bordeaux plots was very slightly russetted and the scorching of the leaves was very slight indeed. The crop was rather better than that of 1927, and the picking and grading were carried out in the same way. Table III shows the results.



A	B	C	D
Lime-Sulphur	Control	10:3:40 Bordeaux Mixture.	5:1:40 Bordeaux Mixture.
<p>The three trays for each treatment give the crop per tree in 1928.</p>			
Front row trays : Slightly Scabbed.		Middle row : Clean.	
		Back row : Badly Scabbed.	

SUCCESSFUL COMMERCIAL CONTROL OF APPLE SCAB IN THE WISBECH AREA.

TABLE III.

Plot No.	Rows	Spray fluid	Percentage weight of Apples				Average crop per tree lb.
			No. of trees	Clean	Slightly scabbed	Badly scabbed	
2	3-4	Bordeaux 5 : 1½ : 40 + Lead Arsenate	8	66	26	9	152
3	5-6	Control (unsprayed)	8	0	10	90	40½
4	7-8	Bordeaux 10 : 3 : 40 + Lead Arsenate	8	74	21	4	110
5	9-10	Lime-sulphur + Lead Arsenate	7½	34	48	18	137
6	11-12	Control	7	0.4	11	88	58
7	13-14	Bordeaux 10 : 3 : 40 + Lead Arsenate	8	71	20	9	126
8	15-16	Bordeaux 5 : 1½ : 40 + Lead Arsenate	8	56	29	15	112½
9	17-18	Control	8	0.3	9	91	28
10	19-20	Lime-sulphur + Lead Arsenate	7	26	52	22	133

Table IV shows the average results for each treatment.

TABLE IV.

TABLE IV.					
Spray fluid	No. of trees	Percentage weight of Apples			Average crop per tree lb.
		Clean	Slightly scabbed	Badly scabbed	
Control .. ..	.. 23	0.24	10	90	41
Bordeaux 10 : 3 : 40 + Lead Arsenate	.. 16	72	21	7	118
Bordeaux 5 : 1½ : 40 + Lead Arsenate	.. 16	61	27	12	132
Lime-sulphur .. 1 in 30 and 1 in 60 + Lead Arsenate	.. 14½	30	50	20	135

The accompanying illustration shows the amount of apples of each grade from one tree under each of the treatments.

The above figures show that, on all the sprayed trees, the three applications in 1928 resulted in a bigger yield and cleaner fruit than was the case with the two sprayings in 1927. The unsprayed trees gave a lower yield of fruit, similarly scabbed to that of 1927. A noticeable feature in 1928 was that apples on the lime-sulphur plots were brighter and of a better colour than on the others, and this was commented upon by most of the growers who saw the plots when picking began. Later in the season the difference in colour was chiefly that occasioned by russetting. Another feature was that all the sprayed plots could easily be distinguished from the unsprayed ones by the much superior appearance of the foliage and fruit buds, even after the crop had been picked. The foliage appeared to be the largest and healthiest on the lime-sulphur plots.

Cost of Spraying.—The prices of the materials used in the trials were as follows : Copper sulphate, 3½d. per lb. ; lime,

45s. per ton ; lime-sulphur, 1s. 3d. per gal. ; lead arsenate, 1s. per lb.

The cost of each application of 220 gal. of Bordeaux mixture (10 : 3 : 40), per acre of 80 trees, was as follows :—

					£	s.	d.
(a) <i>Materials</i>							
Lime	..	..	..	..	0	1	2
Copper Sulphate	..	..	..	..	0	4	10
Lead Arsenate	..	..	..	..	0	11	0
Total					0	17	0
(b) <i>Labour</i>							
5 men for 6 hours at 8d. per man-hour	..				1	0	0
Use of machines	..	..	..	..	0	3	0
Total					£1	3	0

The total cost per application per acre was, therefore, £2, and the three applications cost £6, or 1s. 6d. per tree.

For the half-strength Bordeaux (5 : 1½ : 40) the total cost per acre amounted to £5 11s. 0d. for three sprayings, or about 1s. 4½d. per tree.

The cost with lime-sulphur was as follows :—

<i>First application</i>					£	s.	d.
7½ gal. at 1s. 3d.	..	..	..	..	0	9	2
Lead Arsenate	..	..	..	..	0	11	0
					£1	0	2

Labour and machines cost £1 3s. 0d.,* making a total of £2 3s. 2d. Owing to the strength of the solution being less in the second and third applications the cost was 4s. 7d. less in each case, and the two applications cost £3 17s. 2d. The total cost per acre for three sprayings was therefore £6 0s. 4d., equivalent to about 1s. 6d. per tree.

Returns.—The returns were calculated on the following basis : The cost of packages, freightage and commission were deducted from the returns as shown in the sales account in all cases :—

1927 : Clean fruit £22 per ton ; slightly scabbed fruit £16 per ton ; badly scabbed fruit £7 per ton.

1928 : Clean fruit £24 per ton ; slightly scabbed fruit £17 10s. 0d. per ton ; badly scabbed fruit £8 per ton.

On this basis the returns per tree work out as follows :—

		1927	1928
		s. d.	s. d.
Bordeaux mixture (10 : 3 : 40) per tree	..	17 1	22 9
„ „ (5 : 1½ : 40) „	..	15 6	24 0
Lime-sulphur	..	12 7	21 2
Control	..	3 11	3 4

* Usually the labour required for lime-sulphur is less than that required for home-made Bordeaux, owing to the time taken to make the latter.

The average return for the two years on the control plots works out to about £14 10s. 0d. per acre per annum, which is obviously insufficient to pay for rent, winter spraying and labour. The average return on the two home-made Bordeaux plots, on the other hand, is nearly £80 per acre per annum, which is sufficient to pay for rent, spraying, labour, etc., and still leave a profit of nearly £50 per acre. The average return from the lime-sulphur plots is £67 10s. 0d. per acre, which gives a profit of about £37 10s. 0d. per acre.

Plots 1 and 11 were, as stated earlier, wet-sprayed with a commercial Bordeaux mixture sold as a powder. The gross returns from these plots per acre were only £51 in 1927 and £65 13s. 4d. in 1928.

In comparing the relative values of Bordeaux mixtures and lime-sulphur solution, it must be remembered that the latter will control Red Spider, which is becoming a serious pest in orchards that have been repeatedly tar-sprayed.* Moreover, the apples in the lime-sulphur plots probably had a higher saleable value than those on the Bordeaux plots, and the solution is much easier to prepare than is home-made Bordeaux mixture.

In deciding what spray to use for Scab control the grower must bear in mind that varieties like Stirling Castle, Cox's Orange Pippin and Lane's Prince Albert are susceptible to sulphur injury, and that varieties like Beauty of Bath, Allington Pippin and Lord Derby suffer from Bordeaux injury. It is suggested, therefore, that growers should consult their County Adviser as to the most suitable materials for spraying for their particular varieties.

Summary.—(1) Spraying experiments for two years on the same Worcester Pearmain trees at Wisbech show an average profit of nearly £50 per acre per annum with home-made excess-lime-Bordeaux mixture and with half-strength excess-lime-Bordeaux mixture.

(2) Lime-sulphur gave an average profit of about £37 10s. 0d. per acre per annum.

(3) The cost of spraying was about £4 per acre in 1927 and about £6 in 1928.

(4) The control plots show a loss.

(5) The figures explain why many Worcester Pearmain in the Wisbech district are unprofitable after a certain age.

(6) Tar-oil spraying *alone* was of very little value.

* There was very little "Red Spider" on any of the above plots.

BRITISH FINCHES : THEIR ECONOMIC STATUS*

REV. F. C. R. JOURDAIN, M.A.,

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The Goldfinch (*Carduelis carduelis britannica*, Hart).—The Goldfinch was at one time greatly reduced in numbers, chiefly owing to the ease with which it was captured in the bird-catcher's nets with the assistance of decoys. The restrictions on this pernicious traffic have caused a considerable increase in its numbers and, in some parts of England, it is now quite common, especially in the south-west. In the northern half of England it is not sufficiently common to have any economic value.

Where there are large areas of more or less derelict land, overgrown with thistles and weeds, one is almost certain to hear the cheerful notes of the Goldfinch, and as it is pre-eminently a sociable bird, one may often come across parties of them even in the breeding season, when most birds are too busy to seek the companionship of their kin. In fact, almost the only point to its discredit is that it is (when present in large numbers) an accompaniment or effect of bad farming.

Its food is mainly vegetable, consisting of the seeds of thistles and other weeds, but insect food also forms a considerable part, though only the smaller kinds are taken. Dealing first with this part of its diet, its activities are all to the good. Beetles, chiefly small species such as *Phyllobius*, caterpillars of many species of moths taken from fruit and rose trees in gardens (to which it is very partial), the larvæ of flies (Diptera), and the remainder, unidentified, are all, with the exception of the Hymenoptera, on the injurious list. Aphides, pests of all sorts of field and garden plants, are also freely taken, and probably form a considerable part of the food of the young. When we come to the vegetable side of the diet sheet, the verdict is less overwhelmingly in its favour. Seeds of thistles of several species, Ragwort (*Senecio*), Dandelion (*Taraxacum*), Chickweed (*Stellaria*), Burdock (*Arc-*

* Previous articles have appeared in this JOURNAL, September, 1927, p. 528, dealing with the Hawfinch and the Greenfinch; and October, 1928, p. 651, dealing with the Linnet, Tree Sparrow, House Sparrow, Twite and Lesser Redpoll.

tium), Knapweed (*Centaurea*), and Wild Teazle (*Dipsacus*) are all recorded by Dr. Collinge from post-mortem results. Archibald also includes Groundsel, Plantain, and Horseknap. It is also said to pick out the seeds from Fir cones. Of course the destruction of these seeds is all to the good, but there is the attendant risk that some proportion of the seeds may germinate after passing through the bird. After mentioning this possibility as the worst charge that can be brought against the Goldfinch, Dr. Collinge classes this bird as distinctly beneficial on the basis of 54 specimens examined. We can only endorse his verdict, for its activities are practically all to the good, not only to the farmer, but also to the gardener and market gardener.

The identification of the Goldfinch is a simple matter, for the small size and glimpse of gold wing patches to which it owes its name, together with its unmistakable, varied notes, render it easy to recognize on the wing; while the bizarre arrangement of the colour on the head, in both sexes, is quite different from that of any other British small bird. A deep crimson mask covers the front of the face to just behind the eyes: then comes a band of white: and finally a band of black, which narrows down the sides and comes forward on the top to join up with the crimson mask.

The Bullfinch (*Pyrrhula pyrrhula nesa*, Math. and Ired.).—A rather larger bird than most of our finches (with the exception of the Hawfinch), the Bullfinch is generally a somewhat secretive bird, generally to be met with in pairs, or family parties, and making its presence known by the soft piping note by which the two sexes keep in touch with one another. When on the wing it can always be identified with certainty by the conspicuous white rump, and when at rest the coal-black head, in combination with the bright pink breast of the male and the less striking and more dingy under surface of the female, form good diagnostic characters.

The Bullfinch is in fact one of our handsomest birds, but unluckily his character is less attractive. There are certainly wide stretches of country, woodland and arable, where little fruit is grown, and then perhaps only a tree or two at the cottage door. Here the Bullfinch is almost harmless, or only a potential danger to the small fruit trees, and an occasional well-aimed stone to greet him on his arrival is all that is needful—for the farmer has no grudge against him apart from his damage to the orchard. In fruit-growing centres, such as Worcester, Hereford or Kent, a widely different state of

things exists. With orchards stretching in all directions for many miles, driving the birds away from one month ensures their presence in the next. In estimating the value of Dr. Collinge's painstaking analysis of 484 stomach contents of adult birds and 34 nestlings, we must not lose sight of the fact that they were all received from the counties of Worcester, Warwick, Stafford and Hereford. All these counties, and especially the first and last-named, are largely interested in fruit-growing, and there is a strong probability that the supply of birds for examination arrived from the owners of the fruit farms, out with guns to protect their crops. The results of the analyses certainly justify their action, for although some birds were killed in every month of the year, nearly half of the total (228 out of 484) were shot in the months of April and May. As animal food was almost entirely absent from these specimens we may take it that the food of the adult birds was practically all vegetable. In his volumetric diagram Dr. Collinge estimates the proportion of cultivated fruits as 41 per cent., wild fruits at 15 per cent., and weed seeds at 44 per cent.

We do not doubt that this is a perfectly fair statement of the economic aspect of the Bullfinch in a fruit-growing county. For practically five months in the year, the Bullfinch is a daily menace on a fruit farm, and from the beginning of the year onward it is necessary to keep a sharp lookout to prevent irreparable damage. Even in the autumn, family parties of old and young will settle in a fruit tree, frequently a cherry, and quite methodically and systematically proceed to destroy all the buds on which the crop of the next season depends. Moreover, it is not only the larger fruit trees—the plums, apples and cherries—which are cleared, but the birds will descend to the ground and work their way along a row of gooseberries, not only eating vast numbers of buds, but also destroying almost an equal quantity. Admittedly, shot are not good for the branches of one's fruit trees, but in this case it is a choice between a small amount of damage to the trees and the possible destruction not merely of a year's crop from them, but quite possibly of many later crops. Small wonder that the fruit farmer shoots mercilessly, as indeed he must do. In any case, there are such vast areas where no birds are shot, that any reduction in its numbers can only be local, and will probably be neutralized next season by infiltration from adjacent districts.

We must not forget, however, that even in the fruit-growing

counties 44 per cent. of the food consists of wild seeds. The Bullfinch seeks most of its food among the branches of trees, but to a smaller extent takes food on the ground. In Dr. Collinge's list we find seeds of Sycamore in 5 birds, Hawthorn kernels in 18, Elder in 13, and Blackberry in 48. To this list we may add the Wild or Bird Cherry, Birch, Privet, Blackthorn, Larch and Beech. This part of their diet is, of course, neutral. Seeds of weeds such as Dandelion, Charlock, Groundsel, Curled Dock, Hawkweed, Ragwort, Chickweed, Nettle and Sow Thistle are taken also in some quantity, and their destruction is of benefit to the farmer, but is neutralized to some extent by the risk of seeds germinating from the faeces. Out of 50 droppings examined, 96 seeds of nine species of weeds were germinated.

During the breeding season the nestlings are fed almost entirely on animal matter, chiefly caterpillars (larvæ of Lepidoptera) and also the larvæ of Flies. The late Edward Newman, who was a first-class entomologist, found the Bullfinch feeding on the very injurious larva of the Winter Moth (*Cheimatobia brumata*), so that its visits to the orchard may not be an entirely undiluted evil. To sum up, the amount of actual benefit from the presence of this bird is small. In districts where very little fruit is grown, and that chiefly in small gardens under the crofter's eye, the Bullfinch is almost harmless, and does, no doubt, assist in the destruction of a good many weed seeds. In large gardens with shrubberies attached there is almost certain to be a pair or two resident, and these are likely to prove troublesome to the fruit trees. If there are any well-grown box trees, it is often worth while to scrutinize them carefully from below, as the Bullfinch has a very decided liking for this tree as a nesting site. The nest can be easily recognized by its rather flimsy character for a Finch's nest, and its very characteristic lining of dark, almost black, roots. The eggs are blue with dark brown spots or streaks.

The Chaffinch (*Fringilla cœlebs cœlebs*, L.).—This is quite one of our commonest birds, and is familiar to almost everyone from its confiding habits. It will settle on a road and feed within a few yards of the passers-by. The grey cap and nape of the male, contrasting with his pinky reddish face and breast, his conspicuous white shoulder patches, and his well-known little trill of song, "In-another-month-will-come-a-Wheatear" (with an insistent "Spink" if the nest is approached), enable us to identify him without difficulty.

The hen, while less brightly coloured, bears such a strong family resemblance that she, too, is readily recognized. When it comes to defining the economic status of this species we soon find that it is a matter of weighing up benefit : and drawbacks against one another. The bird's confident habits and cheerful song prejudice us in its favour, but is no question that it is a nuisance on the newly-sown bed, where it may be seen calmly hopping about the lines of cotton and indifferent to the baleful eye with which the gardener regards it.

The diet of this species is varied, for besides seeds of weeds, cereals, buds and fruit, nearly a quarter of its food consists of animal matter, almost entirely insects. The young, too, are fed on insects, almost wholly of an injurious character. Collinge mentions the larvæ of the Winter Moth (*Cheimatobia brumata*) and other small moths, the Apple Blossom Weevil (*Anthonomus pomorum*), etc., as forming part of their food ; and Newstead records remains of Noctuid Moths and their larvæ, Weevils, and an Earwig. Aphides, however, seem generally to form a large proportion of the food of the young, and as two broods are usually reared in the year, each containing four or five young, the amount of active benefit derived from the presence of a breeding pair must be very appreciable.

Apart from the question of the food of the young, the adults show a strong predilection for animal food as well as seeds and other vegetable matter. An analysis of the records shows that the following orders are represented : the smaller Coleoptera (*Beetles*), especially the injurious Weevils (*Curculionidæ*), but unfortunately also the useful Ladybirds (*Coccinellidæ*) ; Hymenoptera, including the injurious Gooseberry Sawfly (*Pteronus ribesii*) ; Diptera, larvæ ; Lepidoptera, small larvæ and moths. Other animal substances recorded are Aphides, Spiders, and eggs of Snails. With the exception only of the Ladybirds, all the above are actively injurious or at best neutral. Aphides are a favourite food, and Hooper states that besides the Woolly aphis or American blight other species parasitic on cherry, plum, damson, apple and chrysanthemum are also taken. Earthworms are also occasionally picked up in gardens, but not in any great quantity.

To turn now to the vegetarian side of the diet sheet, it must be admitted that the Chaffinch is capable of doing a considerable amount of damage to newly-sown beds of turnip, radish, onion, carrot, and other garden crops. In a small

garden this may be guarded against by the use of netting and thread, but unfortunately the bird likes to disbud fruit trees, especially the smaller kinds, such as gooseberries and currants. Even when engaged on this task, it does not as a rule work in noisy parties, like the House Sparrow, or in flocks, but generally in pairs, so that the actual damage is comparatively slight. Against this, too, must be set a steady destruction of weed seeds, which, according to Collinge's tables, take up more than one-half (56 per cent.) of the diet. Some of the species, such as Groundsel and Chickweed, are common garden pests, while others, like Charlock, are farm nuisances, and though a certain proportion pass through the bird without having their vitality impaired, there can yet be no doubt that the greater part of this work is beneficial. Seeds of several species of tree, such as beech and conifers, are also eaten. Corn is readily picked up—but chiefly from the ground in stackyards: Collinge estimates this at about 8.5 per cent., but, except where it would have been picked up by fowls, most of the corn in question is lost or damaged. Some fruit is also taken, but the amount is small. Without giving a clean certificate of character, we can at least say that though a pair or two of Chaffinches may from time to time do an irritating amount of damage in the garden, yet there are always extenuating circumstances, and for the greater part of the year the benefits distinctly outweigh the drawbacks. This is more especially the case when the young are being reared in May and June.

Dr. Collinge's summary of the diet (65.5 per cent. neutral, 18 per cent. injurious, and 16.5 per cent. beneficial) seems rather an understatement of the case, for by his own figures 16.5 per cent. of the food consists of injurious insects and 56 per cent. of weed seeds. Allowing for a proportion of these germinating, there surely must be some balance of credit to the Chaffinch for the 56 per cent. of weed seeds destroyed. On the whole, while it may be advisable to kill off a pair or two from time to time, it would probably pay both gardener and farmer to concentrate on the destruction of a bird like the House Sparrow, which is known to be far more injurious, and to leave the Chaffinch alone.

THE RED SPIDER MITE

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THE Red Spider Mite (*Tetranychus telarius* Linn.) is a notorious pest of many glasshouse plants, and is liable to increase with astonishing rapidity under the conditions prevailing in these structures. In the open, in addition to severe infestations upon hops, the market-gardener may sometimes suffer injury to the foliage of strawberries and violets: such attacks, however, are extremely mild as compared with the depredations of the mite upon cucumbers, tomatoes, carnations, grape vines and French beans, and to a lesser extent upon peaches, roses, arums, salvia and asparagus fern grown under glass.

Fruit trees are seldom attacked by the true Red Spider Mite, apples and plums being usually infested with the European Red Mite, which is entirely different in habit and appearance from the former.

Weeds such as dead-nettle, bindweed, stinging nettle and dock sometimes afford breeding grounds for the red spider mite, and clover, especially of the red variety, becomes badly infested during late summer.

When full grown, the female mite measures only about one-fifteenth of an inch in length, the male being little more than half the size of the female. The presence of the mite is therefore more readily recognized by the effect which it produces upon the foliage of plants: when laying eggs, the female mite feeds voraciously on the undersides of leaves, which soon become mottled through numerous punctures round which the leaf-cells dry out. The young mites only cause this characteristic marking to a slight extent, but secondary damage is sustained when the mites spin over the foliage webs of such a thickness that the leaves practically cease to function.

The general effect of vast numbers of mites upon cucumber and tomato plants is a hardening and stunting of growth, accompanied by withering and whitening of the older leaves, resulting, in very severe cases, in actual death of the plant. The foliage of carnations loses its waxy bloom when attacked, and the flower sepals may be disfigured to such an extent that the flowers become unmarketable.

Life History.—The life history of the mite in glasshouses presents peculiar points of interest, especially during the winter months. In October, the adult female, after fertilization by the male, assumes a brilliant brick-red colour, leaves the plant upon which it has developed, and seeks out nooks and crannies where it can obtain enough moisture to support life. These situations include split plant canes, doorlocks, nail holes, and pieces of hollow straw lying on the ground, and the mite likes particularly to shelter behind hooks supporting the hot-water pipes and behind ventilator fittings upon the outside of the houses, the ridge capping of which is also a favoured spot.

The mites may also wander considerable distances from the houses, and creep on to the foliage of weeds, upon which they seldom lay eggs during the winter, although they have been recorded as doing so when the weeds were covered with several inches of snow, which did not prevent the eggs from hatching and the young mites from developing slowly.

In their red winter form, the mites are gregarious, often gathering in vast numbers in one place, where they spin a common web in which they constantly move about. They do not feed during the winter, and only become inactive at temperatures far below freezing point—and even then sunlight will induce them to leave their places of concealment and move actively over the woodwork of the glasshouse. Experiments have shown that the mites favour a temperature of about 50° F., and are activated to movement more by sunlight than by a rise in temperature.

If plants are grown with heat during the winter, breeding at a slow rate may continue upon certain plants, but most of the red mites lead a comparatively inactive life upon them, irrespective of the warm conditions produced.

When the propagating of cucumber plants commences early in the year, a few mites will lay eggs upon the foliage, which may show considerable mottling, but the injury is usually slight. After hatching from these eggs, the young mites develop as in the summer generation shortly to be mentioned, but on becoming adult they usually turn red in colour, similar to that of their egg-laying parent, and either leave the plants for some crevice or remain inactive upon them for several weeks before laying eggs. The general attack in cucumber houses usually begins at the end of March, some time after the plants have been placed in the borders.

In tomato houses there is a tendency for the spider mite to move upwards from the pipe-hooks and pillars to the ventilators when heat is first put on, and they do not readily return to and lay eggs upon the plants until the end of April. Upon carnations, breeding usually goes on during the whole year, though the periods of greatest activity are in autumn and spring.

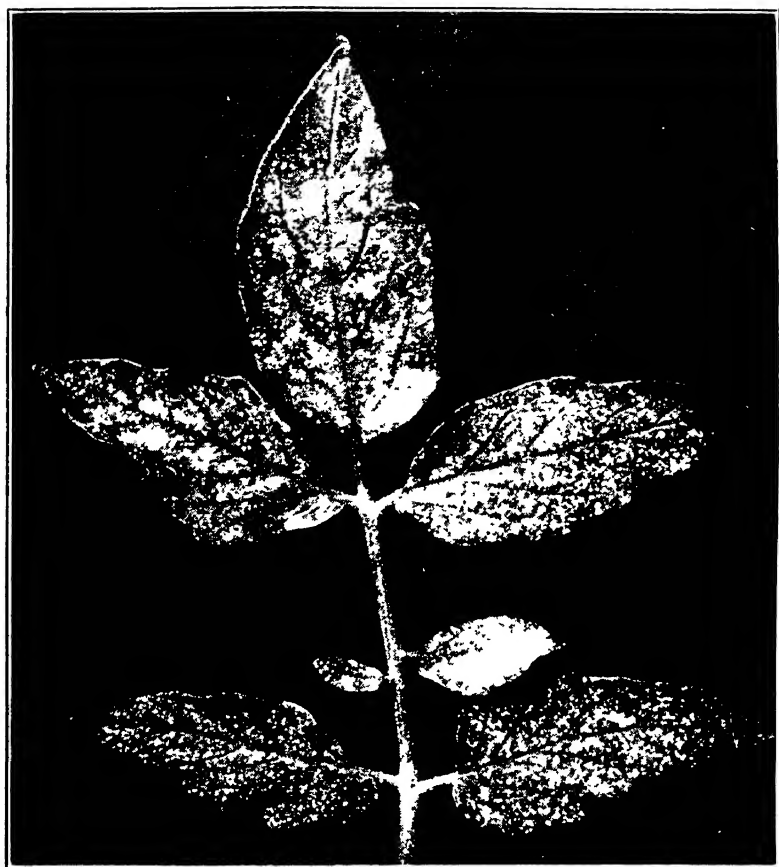
A curious large and reddish-brown form of female, intermediate between the red winter and the yellow or green summer form, is common upon the carnation and also occurs frequently upon tomato plants.

By the end of April, the brick-red winter females have all crept on to, or fallen from the ridge and bars upon, the plants in tomato and cucumber houses, and this type of female does not again appear in subsequent generations until the autumn. There are many successive summer generations, the countless individuals of which feed and lay eggs almost exclusively upon the underside of the foliage, though the fruit of the cucumber (and the orange in southern Europe) sometimes affords a breeding place.

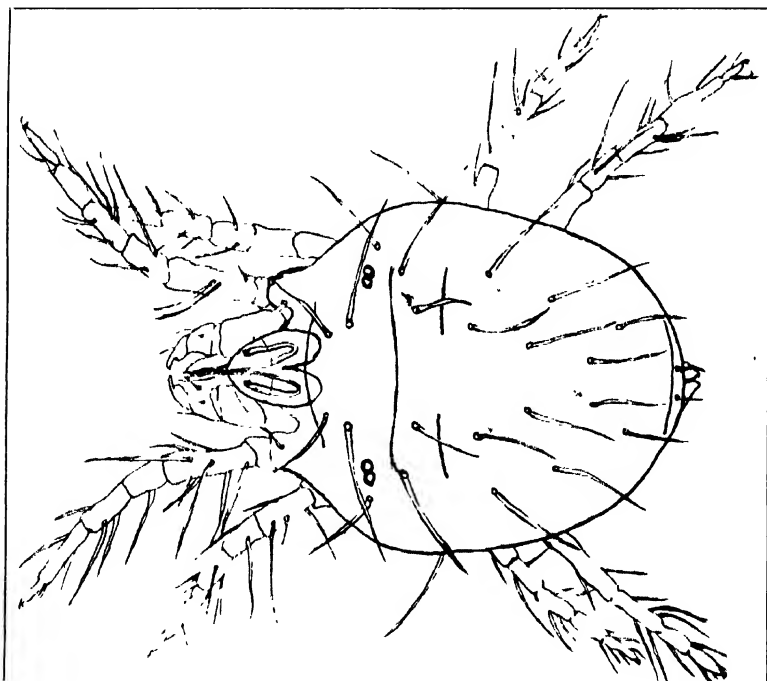
The adult females of these generations are either yellowish or greenish in ground colour, with symmetrical black markings to the sides, but when old they become almost entirely black. Egg-laying by a single female may last over a period of three weeks, during which time rather under 100 eggs are deposited.

The egg, hardly visible to the naked eye, is of a semi-transparent whitish colour, and is globular in shape. From three to nine days after being laid, according to temperature, the egg-shell splits and the feeble, six-legged larva, yellowish or whitish in colour, creeps out. The larval and each successive stage, in which the mite is provided with four pairs of legs, has two more or less equal periods in which the mite is first active and then ceases to move altogether before moulting. The larval stage occupies about two days, and the two succeeding nymphal stages of the female about four days together. The male becomes adult after only one nymphal stage. The average duration of the life history of a single individual from the hatching of the eggs to the reaching of maturity, in hot weather, is 12 days for the female and 11 days for the male.

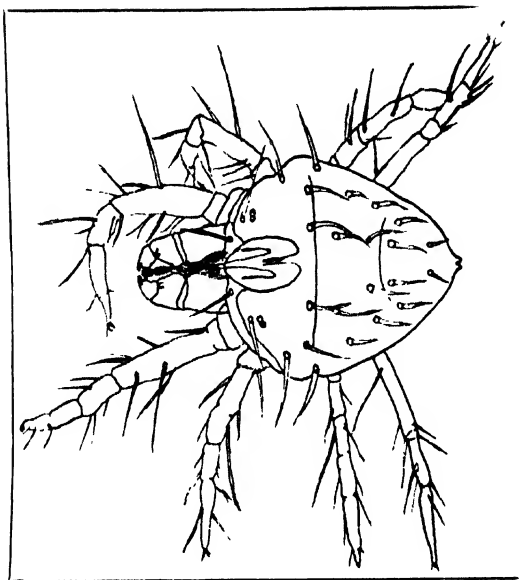
If a cucumber plant becomes very severely infested, as often happens in late summer, although it may occur as early as April, and the food supply of the plant becomes insufficient for the mite, there is a tendency for all stages of the mite to



Tomato shoot showing marking made by Red Spider Mite
(*Tetranychus telarius* Linn.).



Red Spider Mite (*Tetranychus telarius* L.).
Adult female $\times 130$.



Red Spider Mite (*Tetranychus telarius* L.).
Adult male $\times 130$.

assume a pink colour. An adult female will then drop from the end of an overhanging leaf or other eminence, upon a thread sometimes as much as 3 feet in length: down this thread numerous other individuals clamber so that a rope composed of thousands of struggling mites is formed. The majority fall from this rope and run actively away to seek fresh plants, but about 50 stay behind and weave themselves into a loose silken cocoon from which they emerge gradually while the enfeebled plant is putting out fresh foliage. These pink females must not be confused with the red over-wintering female.

In August, during hot weather, there is a partial migration from cucumber and, sometimes, from tomato houses, millions of mites escaping from the ventilators and collecting in masses outside, especially at the ends of the ridge-capping. If a slight breeze is blowing, a mite will detach itself from the mass by a short thread and be blown away. After such a migration mites have been found laying eggs upon French beans and red clover at considerable distances from infected houses.

Control Measures with Fumigants : (1) *Naphthalene*.—Pure commercial white-flake naphthalene, first used at the Cheshunt Experimental Station in 1923 as a fumigant for red spider mite, has since been used extensively in cucumber houses. At temperatures above 74° F., and in air containing much moisture, the vapour of naphthalene first causes the mites to drop from the foliage and hang struggling upon their web. Death ensues in from 24 to 36 hours, all stages of the mite (including the eggs) being killed in this time, provided that the supply of vapour is kept up. The latter condition is best fulfilled by using flake naphthalene which has been passed through a sieve of 16 meshes to the inch, sold commercially under the name "Naphthalene Grade 16."

A minimum quantity of 3 lb. of naphthalene to every 100 ft. run of border (6 lb. to 100 ft. house) is broadcast over the borders and paths of cucumber houses in the evening, shortly after the borders have been well watered and the plants thoroughly damped overhead.

The next morning the ventilators are opened for a short time to allow of overhead watering without undue inconvenience to the operator, and closed immediately after damping over until the evening, when another similar overhead damping may be called for. If suitable temperatures are kept up, especially during the night, the odour of naphtha-

lene should be hardly perceptible 36 hours after the fumigation was begun.

As the fruit of the cucumber plant readily absorbs the odour it should either be cut shortly before fumigation or, if cut subsequent to fumigation, should be well-aired before sending to market.

Naphthalene is not a suitable fumigant for tomatoes and carnations grown on a large scale, because of the difficulties encountered in keeping up the necessary conditions of temperature and humidity over a comparatively long time without running serious risk of injury to the plants. Some success, however, has attended the use of naphthalene in vineries, where the naphthalene is melted in a bucket and painted upon the hot pipes with a brush: it is essential, however, to keep a moist atmosphere in the houses to prevent scorching of the foliage.

Mechanical contrivances for volatilizing naphthalene by heat should be used with great caution upon growing plants, as severe damage has resulted from overheating and from unsuitable conditions prevailing at the time of fumigation. After crops are finished, considerable mortality of the mite has been obtained by this method, provided that the houses have been kept well heated during the fumigation. For winter treatment such fumigation is best carried out at the end of the growing season rather than at a time shortly before planting. In the latter case a large proportion of mites will have wandered to the outside of glasshouses, where the fumes cannot affect them.

(2) *Sulphur*.—The vapour of sulphur is poisonous to Red Spider Mite, but the mite is not killed when sulphur is burnt to sulphur dioxide in glasshouses. The latter gas is extremely harmful to plants, even in very small quantities, and the difficulty of vaporizing sulphur without combustion has rendered true sulphur vapour as a fumigant for the mite uneconomical. Grape-vines, however, are still fumigated with the vapour for mildew, when a good kill of the mite is obtained, but the method is costly in labour, as constant attention throughout the fumigation is necessary in order that any sulphur which catches fire in the trays over the spirit lamp shall be immediately extinguished.

Control Measures with Sprays : (1) *Petroleum Emulsion*.—While emulsions of ordinary burning paraffin have little, if any, action upon the red spider mite, considerable success

has attended the spraying of infected cucumber and tomato plants with emulsions of heavier and more refined petroleum. Such emulsions are difficult to make and must be obtained ready made. They should contain at least 80 per cent. of refined petroleum, and be emulsified with small quantities of a caseinate and soft soap. Ammonia is added in order to preserve the caseinate from decomposition. When spraying, hard water may be used, and dilutions ranging from 1 part of emulsion to 80-100 parts of water give a good mortality of the mite.

As all the eggs are not killed, it is advisable to repeat the spraying from 7-14 days after the first application, but tomato plants should not be sprayed subsequently more often than once in three weeks, certain diseases, such as dropsy and *Botrytis*-rot, being aggravated by repeated spraying, especially if watering is not carefully regulated.

Sprayed plants require less water than normal after spraying with paraffin emulsions, which should never be used upon carnation plants.

(2) *Liver of Sulphur*.—A solution containing one-half per cent. of potash soft soap and one-quarter per cent. of commercial liver of sulphur is very effective as a spray for red spider mite upon tomatoes and carnations if rain or soft water is used for spraying.

Concentrated stock solutions will not keep for long without deteriorating in efficiency, and the spray has limited use, as soft water is seldom available on large nurseries and difficulty attends the dissolving of the soap. The latter objection is obviated by the use of fusel oil.

A more or less permanent stock may be made as follows :—

No. 1.—Dissolve $\frac{1}{2}$ lb. commercial liver of sulphur in 16 fluid ounces cold soft water.

No. 2.—Heat in a large saucepan $\frac{1}{2}$ lb. of a good horticultural potash soft soap with 4 fluid ounces fusel oil, and stir until the soap is completely dissolved.

Allow No. 2 to cool, and strain No. 1 through a fine cloth into it.

The stock should be kept in a corked bottle and be well shaken before use.

For application, one part of the stock should be added to 49 parts of soft water, and this must not be allowed to stand long before use. The whole stock is sufficient for 20 gallons.

This spray is especially useful for the control of the mite upon carnations, as it has little effect upon the waxy bloom of the leaves. A second application is advisable from 7-14 days after the first.

Winter Treatment.—Low cucumber houses may be fumigated by broadcasting a liberal quantity of Grade 16 naphthalene over the whole soil surface at the end of the season shortly before the plants are removed. The fumigation should be continued for four days, a second application of naphthalene being made if the fumes from the first become weak. For large-span houses ordinary naphthalene may be volatilized from special lamps.

As an alternative, shortly before the removal of cucumber and tomato plants from glasshouses at the end of the growing season, the plants, glass and woodwork of infested houses should be thoroughly sprayed with cresylic acid or a mixture of the latter with soft soap. If used alone, pale straw cresylic acid of 98 per cent. purity should be used at a strength of not less than one part in 40 parts of water.

The mixture with soap is made by heating one gallon of cresylic acid with 8 lb. of household potash soft soap until all the soap is dissolved. This can be stored in drums, and is used at a strength of not less than one part in 40 parts of water.

If the extent of the nursery permits it, the houses should be sprayed outside as well as inside, and a second application should be made from 14 days to three weeks before replanting, in order to allow the cresylic acid fumes, which are very injurious to plant life, to disappear. When spraying, the ventilators should be kept open, and then closed for four days, as much heat as possible being put on during this period. To trap the over-wintering mites in badly infested houses at the end of September, dry straw may be strewn between the plants in tomato houses, and strips of corrugated cardboard placed on the hot water pipes over the supporting hooks. The straw should be carefully collected and burnt with the plants when the latter are removed, and the cardboard collected at intervals of one week until the middle of November and burnt. It is advisable to raise the ridge capping of infested cucumber and tomato houses, so that about $\frac{1}{4}$ inch space is left between it and the ridge-board.

The use of canes to support plants is always to be avoided, as the mites are exceedingly difficult to kill when lodged inside them.

The mite is usually introduced into the propagating houses upon staging which, when not in use, has been stacked amongst weeds outside. It is therefore very important to keep all staging in a dry shed whenever it is not in use for growing purposes.

"BUTTON TOP" OF BASKET WILLOWS

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The condition of Basket Willows known as "Button Top" is illustrated in Fig. 1, A, B, C, and may be briefly described as a small rosette or button-like malformation of the young leaves and buds situated at the ends of willow shoots. The formation of these "buttons" is followed by a very great decrease in, if not complete stoppage of, end growth, and by the production of side shoots from the lower lateral buds. The result is that the matured rod is of little economic use. As attacks occur annually there is often great loss in crop value.

The problem has been to discover the exact cause of "button top" and to find measures of control. Accordingly, work to this end is being carried out at Rothamsted. The purpose of this paper is to explain what is known concerning the cause of "button top" and to suggest a possible means of control.

Cause of "Button Top."—"Button top" is the result of an attack on the willow plants by the grub of a very small midge (*Rhabdophaga heterobia* H.Lw.) which belongs to the family of gall midges or Cecidomyiidae (Fig 2, B). The midge is visible to the naked eye, the body varies in colour from red to dark brown, and the legs and wings are covered with dark scales and hairs. The grubs of this midge are orange-red in colour; when newly hatched they are extremely minute, while fully-grown examples measure about $\frac{1}{10}$ in. in length. It is the feeding activities of these grubs that cause the gall-like malformations of the willow end-buds termed "buttons."

Nature of Attack.—Two main sets of "buttons" are present on a typically attacked plant, viz. the one formed in the early part of the year at heights of 1-2 feet above the ground level, and the other, formed later, higher up the rods. In addition, innumerable "buttons" are formed at the ends of many of the smaller side shoots.

Life History of the Midge.—There are two main broods of the midge each year. In Fig. 3 the letter A represents "buttons" a foot or so from the ground made by the main attack of the first brood. Considerably higher up, there is another set of "buttons" (B) resulting from the main attack of the second brood. Just below both these sets of "buttons,"

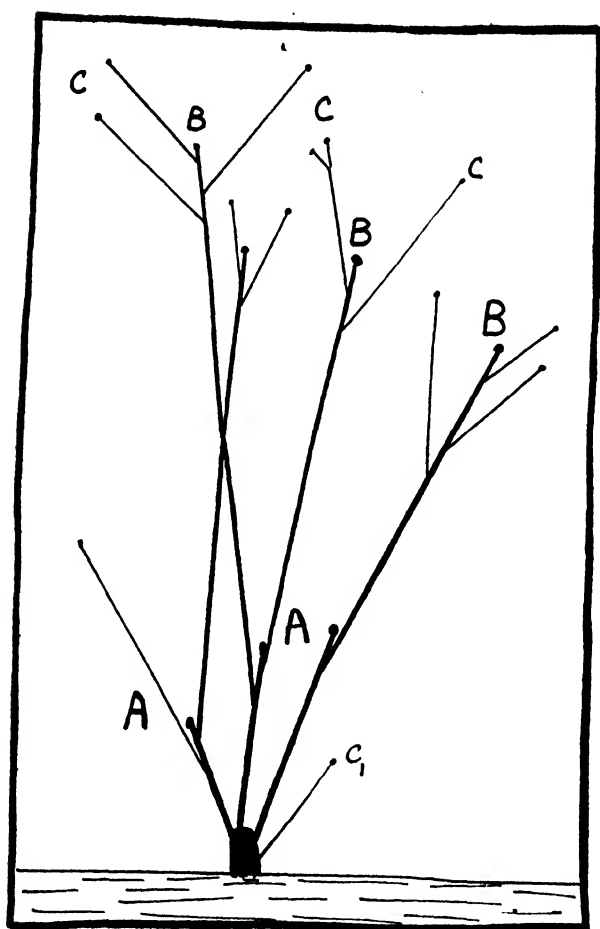
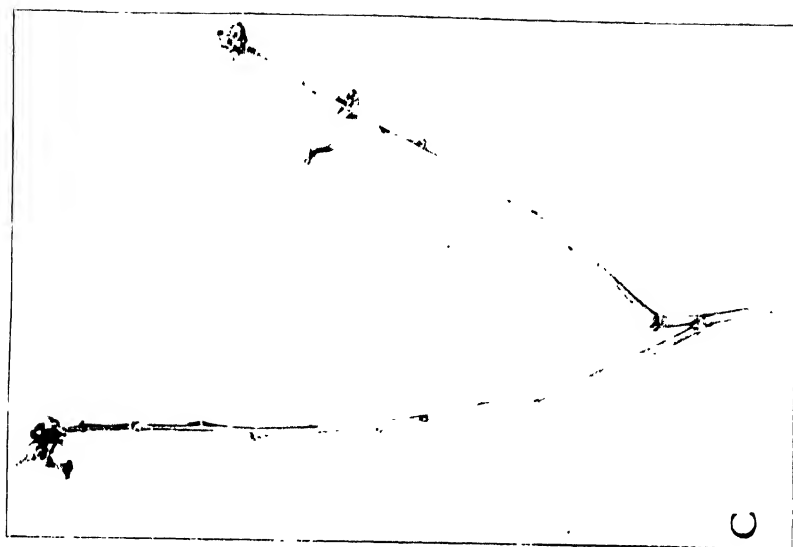


FIG. 3.—Diagrammatic representation of osier attacked by button top midges. A, main 1st brood attack. B, main 2nd brood attack. C, secondary attacks of 2nd brood. C₁, late 1st brood or stray 2nd brood attack.

numerous side shoots are seen causing a branched appearance of the rods: the side shoots from near "buttons" (A) grow well away before the second attack, but those resulting from the second main attack are usually found to have "buttons" also. These "buttons" (C) are the result of later emergences of the second brood midges. Further, at the base of the stub, one often finds poorly-grown shoots also bearing "buttons" at the ends (C₁). These may be due either to late first brood midge attack or stray attacks by the second brood. The midges of the first brood start emerging at the end of April and continue until the second week in July. Egg-laying



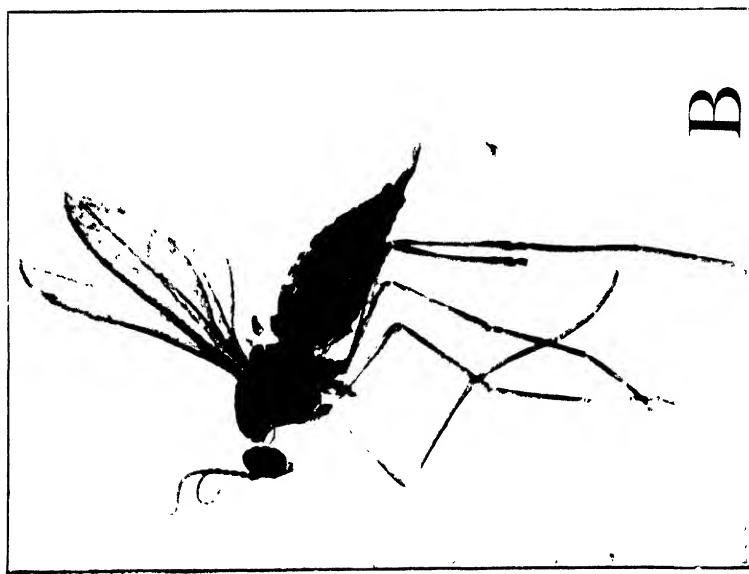


FIG. 2.—Female button top midge (*Rhabdophaga heterobia* H.Lw.).

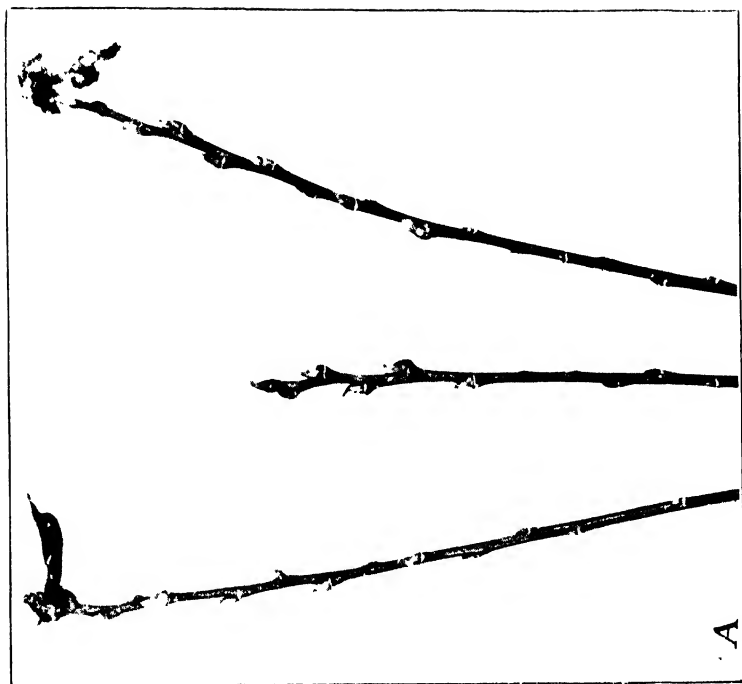


FIG. 5.—Attacked lateral bud.

starts a few hours after the emergence of the midges. Owing to this lengthy period of emergence, midges from the second brood of adults overlap those of the first brood. The second brood is on the wing from the beginning of July until September.

The midges lay their bright red eggs on or near the growing points and after about a week the grubs hatch. Three weeks later the "buttons," formed by the action of the grubs on the buds, are readily seen. As many as 40 grubs have been found in one "button," although the average number is considerably lower; it may be as high as 30 in some districts and seasons. In the normal course of events, the grubs stay in the "buttons" throughout their life. The grubs of the first generation almost invariably stay in the "buttons" and turn into pupae; they always turn to pupae somewhere, i.e. in "buttons" or in the soil. As has been stated above, midges of this first generation are on the wing at the beginning of July, thus the life cycle of this generation takes two months to complete, during the whole of which time the cause of the damage is in the "button" which is being formed.

Grubs of the second generation attain their greatest size by October. Normally the grubs would stay in the "buttons" in a resting stage until the following April, but observation has shown that, as soon as frosts occur and the weather gets cold, tits and other birds start hunting among the "buttons" for the grubs. As a result some of the grubs are eaten, but large numbers are dropped to the ground and finally turn to pupae below the surface. The effect of temperature and the weather generally is of the utmost importance, as it affects the time at which the tits start spreading the grubs. It has been observed that this distribution probably occurs in November, since "buttons" containing numerous grubs in October have been found to be empty in December. This fact may be of great importance as it suggests a stage at which control measures might be applied.

It has been found under laboratory conditions that the midge grubs can survive in the soil throughout the winter, in spite of flooding and frosts, and emerge as midges normally the following year, although perhaps the emergence takes place slightly later than usual.

Alternative Attacks by the Midge.—Besides attacking the end buds of osiers, the midge has two other lines of attack. It is known that certain varieties of osiers bear catkins twice in



FIG. 4.—Abnormal male catkin due to midge attack.

the year. The "button top" midge lays its eggs in male catkins and this produces a malformation (Fig. 4), in which the stamens and scales are thickened and the affected part of the catkin is white and woolly in appearance. Such catkins may be found in early spring on two-year-old rods, and also in August and September on rods of the current year's growth.

The second alternative line of attack affects the lateral buds. When such an attack has taken place the buds which are attacked are swollen and contain up to 12 grubs. These buds are very easily seen (Fig. 5, A) and appear always to be the last, or highest, six or eight on the shoots. This mode of attack has only recently been recognized and is very important. It has been pointed out that the flower buds are similarly swollen and are liable to be mistaken for infected buds. There is, however, no such clear-cut line of distinction between the swollen catkin buds and normal leaf buds as is the case in buds attacked by the midge grubs and normal leaf buds.

Although certain details in connexion with the life history of the midge still require investigation, the facts so far ascertained would appear to be sufficient to warrant the publication of this paper on the grounds of the importance of

the subject to growers. Suggestions as to practical methods of control which might be tried by willow growers are given below.

Natural Control.—It has been observed that, under prolonged wet weather conditions, a diminution in intensity of attack occurs. Besides this, large numbers of insects are known to feed parasitically on the "button top" grubs. It is also probable that many adult midges are taken by birds in flight. Further, it is known that tits eat large numbers of the grubs in autumn but, in so doing, spread other grubs to the soil, making control difficult and thereby doing more harm than good. Although these three natural agencies in the control of the increase in the number of midges exist—*viz.* wet weather, parasites and birds—none of them either singly or collectively can be regarded as adequately protective.

Artificial Control.—Three stages in the life history of the midge suggest themselves as times at which artificial control might possibly be effective. The first stage occurs when the midges are on the wing, and the measure suggested would have as its aim the prevention of egg-laying. Spraying might have proved a feasible control method if the egg-laying period was definite but, since midges are on the wing and, therefore, egg-laying almost continually from April to September, this does not seem hopeful.

The second stage is when the grubs are in the "buttons" during the summer months. Here we are confronted with the additional difficulty that the grubs feed inside the "button," bud or catkin, as the case may be, and are hence inaccessible to spray fluids. In addition, in most cases spraying machines could not operate amongst the crop after the end of June owing to the growth and size of the rods. "Buttons," however, can be removed by hand-picking and destroyed, and by continuing this procedure during the summer as long as the crop was accessible, satisfactory control should be secured.

The third period is the autumn, and this is much the most hopeful. It will be seen from the foregoing account of the life history of the midge that, during late September and October, providing the weather has not turned cold and the tits have not started attacking the "buttons" and buds, all the grubs are restricted in position—*i.e.* in the "buttons" and buds. Further, no adult midges, or any other stages in the life history of the midge, are to be found at this time of year.

It is the usual practice to start cutting the rods as soon as the leaves have fallen, generally some time in November. This cutting goes on steadily till the spring. If the rods are required for "buffing" the sooner they are cut the better. If, on the other hand, the rods are required "white," they may be left on the heads till March. When the cutters have cleared a sufficient area the rods are tied into bolts, which are left in the field for a week or so and then carted off to the factory or pits as opportunity arises. During the period they are lying in the field the "button top" grubs will be leaving the "buttons" and buds and making their way to the soil.

It can be readily understood that leaving the bolts lying about the fields ensures the "button top" midge being present the subsequent year, since the grubs always leave cut rods in a very short time and fall to the ground. It is also known that, owing to labour difficulties and large acreage, it is impossible to cut all the osiers quickly; this must be done as weather and other factors permit.

If, however, directly the rods were cut and tied into bolts they were removed to the pits or stacked on a restricted area near the pits on a definite surface, such as concrete or cinders, then a new state of affairs would exist. Instead of having the grubs in the soil throughout the osier beds, the grubs would be now only in the pits and on this stacking surface. The grubs that left the rods in the pits would probably float for some time and then get washed to the sides of the pit. Here they would bury themselves in the soil just above the water line. Likewise the grubs that would come out of the rods stacked on the surface would all be on this surface trying to bury themselves. In both these positions on the sides of the pit and on the stacking ground they would be open to attack by suitable contact sprays. Of course, all peelings should be burnt and not left to propagate the midge.

That such would be the case is illustrated by one commercial bed visited. Here the pits are in the corner of one field and the bolts are peeled near the pits. In this field "button top" attack is always very severe, while the beds further away are far less severely infested. Bolts from all over the beds are brought through this field to the pits and so an accumulation of grubs occurs here, and the heaps of peelings greatly increase the numbers of grubs waiting to cause "button top" the following year. It would pay growers to cut the whole crop

for "buffing" for a season or two, if by so doing "button top" could be brought down to a minimum.

Summary.—The cause of "button top" condition in basket willows is the grub of the gall midge, *Rhabdophaga heterobia* H.Lw.

This midge has two main broods a year, but the two broods overlap considerably, giving the appearance of continuous broods from the end of April until September.

Besides attacking the end buds, the grubs also attack male catkins and lateral buds.

The grubs normally turn into pupae in the "buttons," buds and catkins, but also survive throughout the winter in the soil after being dropped by tits.

Natural agencies controlling the increase in the number of midges are found to be inadequate and measures of artificial control are discussed.

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DO YOU WANT INFORMATION OR ADVICE?

If so, do not hesitate to consult the County Agricultural Organizer, who will be happy to be of service, either directly or in consultation with one of the many educational or research institutions. The Ministry's Leaflet No. 279 will tell you how to get sound information and guidance on your many problems of cultivation. The leaflet will be sent gratis and post free on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

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APRIL ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),
Agricultural Organizer for Derbyshire.

Grassland.—The name of this month suggests the opening of the growing season, and commonly it is a period in which there is rapid change from winter to spring conditions. The old Dutch name for April was Gras-maand, meaning grass month. In some years, 1926 for instance, there is good grazing on most fields by the 15th; in others, however, the mean temperature of the two preceding months is so low that there is little pasturage in April and stock are largely dependent on hand feeding until the arrival of May.

There is a general impression that unusually severe weather in winter is likely to be followed by corresponding warmer weather in the spring. A study of the weather records of previous years (1895, 1902 and 1917) which have had keen frost in February does not, however, lead one to expect March and April to bring conditions warmer than those typical of these months. Unless this year differs from those above-mentioned, therefore, the grazier, and especially the owner of a grassland flock, will have to incur considerable expenditure in trough and rack feeding before May comes in.

At the time of writing (mid-March) grass fields of all qualities present a grey and lifeless appearance, and all pastures have to begin on a common dead level. It will be interesting to observe the effect of nitrogenous top dressings applied to land that was intended to produce an early bite. Already the sward of rich or treated land is beginning to show green young shoots at the base of the withered foliage; and doubtless such fields will respond quickly to such rains and warmer weather as are now due; but it would seem that the lesson of the recent frost is to emphasize the limitations of the "early bite" as a means of reducing the cost of winter feeding.

April Tillages.—Ploughing and sowing operations were prevented by the frost-bound state of the ground during February and the beginning of March, and it is likely that there will be considerable areas of oats and barley to be sown in April. It is well known that late sowing of oats ordinarily involves risk of frit-fly attack, and the question is being asked whether the severe frost may not have destroyed most of the grubs which, as such, live on grasses during the winter. Insect larvae are not very susceptible to frost injury, but it is reasonable to hope that the development of the frit grubs has been

delayed. The severity of the damage done by this pest, however, largely depends on the weather of May and June as well as on the time of sowing: in 1922, which was a notoriously bad frit year, the previous hot summer and mild winter were followed by a hot dry May and a dry June.

It is anticipated that the soil will work down well for mangolds and beet; the value of allowing the seed bed to become settled before drilling may, however, be emphasized. Ridging up is advantageous in this connexion, as it permits of the exposure of firm, moist earth in which to drill: this is performed by lightly harrowing the ridges. Doubtless an increased acreage of marrow-stem kale will be drilled during this month to take the place of cabbage plants, where these have been destroyed by frost. Those who prefer ox-cabbage may, however, drill cabbage seed in the field and thin out the plants to the desired distance. Eclipse Drumhead may be recommended as a suitable variety for drill sowing, as it can be grown closer in the rows than ordinary ox-cabbage; for late use, however, Utility is a good sort.

The question of cereal and legume mixtures for hay will doubtless be considered for fields where clovers have been damaged beyond recovery. A typical mixture consists of $2\frac{1}{2}$ bushels of oats and 1 to $1\frac{1}{2}$ bushels of field peas. Peas are preferable to vetches for haymaking purposes. This mixture may also be considered as a preliminary cleaning crop on land that is becoming rather too dirty for corn alone; for besides keeping weeds down, if liberally treated, it is cut in time to allow of late summer cleaning operations. Dairy farmers who have hitherto relied largely on wet brewers' grains—now becoming scarce and expensive—might well consider the possibility of substituting vetch and oat silage with which to fill their pits.

Milk Problems.—Two bulletins of unusual interest to milk producers have been issued during the past month. The first, from the Agricultural Department of Bangor University College, deals with the production and sale of Grade A (T.T.) milk on the College Farm. The part of the bulletin which reviews the experience of building up the herd of about 40 non-reacting cows and heifers should afford considerable encouragement to the dairy farmer who contemplates similar action, but it emphasizes the advantage for this purpose of maintaining the herd by home-breeding rather than by the purchase of cows. The details of the costs and returns from producing

and selling the superior as compared with the ordinary grade of milk, however, suggest that the additional price obtained, viz. 1d. per quart, is not in itself sufficient to cover the additional cost of production. Nevertheless, there is no question at the College Farm of returning to the old system of milk selling. There are, as the report explains, several important considerations beside that of the immediate financial results—"the solid satisfaction of knowing that a good article is being produced and that it will reach the consumer's table without risk of adulteration or contamination"; avoidance of complaints about souring; facility in checking retail sales; elimination of loss from tuberculosis in cows; and, lastly, the effect on medical and public opinion in relation to increased consumption of milk.

The other bulletin is specially noteworthy as being the first publication issued by the new Hannah Dairy Research Institute at Glasgow, and it is one of wide practical and national importance. It bears the name of Archibald Macneilage, jun., who was engaged by the Scottish National Milk and Health Association to carry out an investigation on surplus milk and milk residues in Scotland. The report shows that 59 per cent. of the total milk output of Scotland is marketed in the liquid form; 24 per cent. is "manufactured," and 17 per cent. is consumed on the farms. As regards the quantities of milk which enter the centres of consumption, it is shown that little surplus is received there, as the majority of wholesalers contract for their minimum requirements, and where necessary draw extra supplies from creameries. It is in dealing with surplus and residues in centres of production that there is room for organization for the elimination of waste. The quantity of separated milk wasted is stated to be about $1\frac{1}{2}$ million gallons—sufficient to furnish the whole of the Scottish imports of condensed separated milk. The wastage of whey amounts to $4\frac{1}{2}$ million gallons. There is, the report states, a lack of co-ordination between the various concerns handling milk in bulk, which leads to uneconomic handling and excessive wastage. A considerable part of the bulletin deals with methods of utilizing surplus milk and milk residues, and the respective costs and returns are discussed. Such an investigation is an essential step in the efficient organization of the milk industry, and a similar study of the same problem in England is urgently needed.

Poultry Raising.—Poultry now occupy such an important place in general agriculture that the farmer himself, not only

his wife and daughter, takes an interest in incubators, brooders, and the details and problems of chick raising. One of these problems is that of mortality in chicks during the first week or two after hatching, and another—if it is not largely the same problem—is that of “dead in the shell.”

Among specialist poultry breeders as well as among general farmers, however vociferous they may be concerning the misfortunes of their industry as a whole, there is too much reticence regarding the losses they suffer individually; and mortality in the hatching and rearing of chicks is a typical example. When the embryonic mortality in a hatch is excessive, blame is laid on the incubator or some fluctuation in temperature or moisture conditions. Losses after hatching are attributed to chills, errors of diet, or to inherent lack of vigour. These losses can be very serious indeed, often leading to unnecessary changes in equipment and methods and even to the abandonment of schemes for the development of the poultry branch of the farm.

It must be granted that errors in incubator management may cause embryonic mortality and deformities, but “sound” eggs can undoubtedly tolerate a certain amount of variation from the normal incubating temperature. As regards moisture conditions, this problem can be solved by the use of a hygrometer, an inexpensive instrument that enables the operator to ascertain whether he is supplying the correct amount of moisture at the different stages of incubation. Likewise in rearing; sound, healthy chicks are not difficult to carry through the first-fortnight stage and are capable of enduring a certain amount of erroneous treatment.

In the writer's observation and experience, one of the main factors in successful incubation and rearing is the use of eggs that are free from the germ of bacillary white diarrhoea. Before condemning an incubator, or artificial incubation generally, after a bad hatch, specimens of the eggs containing chicks that have died about the 20th or 21st day should be submitted to a bacteriologist for examination. Mortality after hatching should be similarly investigated.

The cause, diagnosis, etc., of the above-mentioned disease are fully dealt with in the Ministry's Leaflet No. 149. It may be here mentioned, however, that the causal organism is transmitted by infected hens through their eggs, and that chicks from such eggs may infect others in the incubator and brooder. Fortunately, it is possible by means of the blood test to detect hens that carry the disease; and the elimination

of reactors from the breeding pen is the first step in the prevention of future trouble from this source.

Abundant evidence of the value of blood-testing breeding stock is afforded in a bulletin recently issued by the Essex Institute of Agriculture. On 15 poultry farms the average chick mortality in 1927, before testing, was nearly 50 per cent. ; in 1928, after testing and removing the reacting hens, the chick mortality on these farms averaged only 6 per cent. In the light of the above figures, it is not surprising that Essex poultry keepers are now utilizing the facilities of the Institute to the extent of testing over 20,000 birds per annum. Obviously the singular reticence in the matter of individual losses and ill-luck has been wisely abandoned in that county. The charge is 6d. per bird.

Tractor Work.—About eight or ten years ago the farm tractor was a subject of regular discussion in farming circles ; large-scale field demonstrations were held in 1919, 1920 and 1921 ; and in these as well as in the show yards, many types and sizes of machine were exhibited. At that time corn was valuable, horse labour was expensive, and conditions generally favoured the application of mechanical power to arable cultivation. The farm tractor had not, however, emerged from the experimental stages. After 1921, as arable cultivation became less remunerative and team work less expensive, interest in tractors subsided and many mechanical cultivating outfits went out of service. Many makes of tractor have since ceased to be manufactured or imported into this country. A small number of types, however, have survived, and improvements have been made as a result of the severe testing period of the past eight years ; and, as mentioned in these notes in January of last year, these have proved more durable, more dependable, less costly in upkeep, and generally more serviceable on farms than their predecessors.

While many farmers find their tractors to be of great assistance—one speaker at the recent Winchester Conference stated that his five engines had saved him from ruin—there are many others who cannot or do not obtain sufficient service from their tractors to demonstrate the value of this class of equipment on their holdings. In a recent survey of 866 farms in Oxon, Northants, Wilts and Berks, the Oxford Institute of Agricultural Economics found that on 162 farms of all sizes where tractors were available, the arable area worked per man employed was 3·6 acres greater than on the 704

non-tractor holdings; similarly, on the tractor farms the arable area per horse kept was 6·8 acres greater. These increases are surprisingly small: they represent a gross saving of less than £30 per annum, which is insufficient to justify the purchase of a tractor, unless other considerations are of greater importance. One of these considerations—the execution of operations at the most favourable time—is difficult to evaluate, but it is admittedly an important one on heavy land, or on large farms.

According to the evidence of cost records, farm tractors in this country perform on the average between 300 and 700 hours' work per annum, at a cost of 3s. per hour. The farm horse works on the average 1,500 to 1,700 hours each year, at a cost of about 5d. to 6d. per hour. The remarkable fact here is the small use made of the tractor. Obviously there is greater scope for tractor work on large arable farms with large fields and a comparatively dry climate. Of considerable influence, however, is the mechanical interest of the farmer or his son: some are very ingenious in exploiting the labour-saving possibilities of mechanical power, and are able to harness the tractor for almost every farm operation. Cases of almost entire elimination of horse labour stand out in marked contrast with those in which the possession of a tractor has not been followed by any reduction in horse and manual staff.

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FRUIT growers and representatives of the Fruit and Vegetable Committee of the National Farmers' Union, to the number of about 30, recently attended, by invitation, a preliminary demonstration of the "Ideal" Apple and Pear Grader, given by the Ministry.

This grader is of a type extensively used in America, and differs in principle from the better-known Cutler Grader in that sizing is done by diameter and not by weight. The possibilities of this machine for grading pears was a matter of general comment.

It is intended to give further working demonstrations of this machine in the provinces as opportunity offers.

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NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,

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Sugar Beet.—The future of the beet crop in this country largely depends on the possibility of securing higher yields per acre. On the Continent, where the crop forms the basis of arable farming, yields are considerably higher than in England. Thus, in Germany the average yield of the seasons 1924-27 was 10·1 tons per acre, in France it was 9·8, in Denmark 11·4, while our yields in the same period averaged 7·5 tons.

Although skilful and thorough cultivation is probably the biggest single factor in securing a good yield, the proper use of manures is a great aid, and generous all-round manuring is a regular feature of beet growing practice wherever the best results are obtained.

No crop has received more attention from experimentalists on the Continent than sugar beet, and a brief notice of the main conclusions as regards the manuring of this crop in Germany may be in place here. The best results are obtained where dung is used either direct or for the previous crop. Heavy applications are not necessary: a dressing of 12 tons per acre, applied in autumn and supplemented by a complete mixture of artificials, is satisfactory. Green manuring may economize but not replace farmyard manure. The crop does badly on soils in need of lime, and attention to this matter is a preliminary to the successful cultivation of sugar beet. Waste lime from near-by factories is widely used by growers.

A good supply of nitrogenous manure is required in the early life of the plant, and most of this should be exhausted before the ripening period. If sulphate of ammonia is used it should be applied before sowing; this point is still more important where cyanamide is given, and it is not unusual on the heavier soils to plough in this fertilizer in winter. Nitrate of soda is given in the form of early top dressings, the last application taking place immediately after singling. Approximate dressings of nitrogen in terms of sulphate of ammonia would be from 1-2½ cwt. where dung is used, or 2½-3 cwt. without dung. Excessive and late nitrogenous dressings prevent the beet from ripening off and depress the sugar content.

Phosphate is particularly beneficial when the crop is in the early stages, and a little water-soluble phosphate has special value at this time. In terms of superphosphate about $3\frac{1}{2}$ cwt. is recommended without farmyard manure, or about 2 cwt. with dung.

Potash is sometimes dispensed with on rich soils where good dung is available, but otherwise it is always given. The low-grade salts are preferred for the lighter classes of land and the high-grade salts for stiffer soils. The commercial potash salts are regarded as containing enough common salt for the crop. Potash salts should be applied well before sowing. In terms of muriate of potash, dressings recommended are up to $1\frac{1}{4}$ cwt. with dung, or 2 cwt. without dung. Progress is being made in the attempt to measure dressings in terms of soil tests rather than to work on general recommendations.

Officially Recorded Results.—Experimental results are accumulating in this country from most of the counties where the crop is extensively grown and also from districts where as yet the possibilities are being only explored. A recent publication* setting out the main conclusions from an extensive series of demonstrations on sugar beet carried out in 1927 in many parts of the country can be recommended to growers. It deals with cultivation and also with manurial problems. As far as the latter are concerned interest chiefly centres round the nitrogenous effects. Dressings of sulphate of ammonia up to 3 cwt. per acre showed a definite increase of sugar per acre in most cases, although in the Fens heavy dressings at drilling time did not increase it, while on soils receiving heavy dunging the effect of nitrogen was not so great. Too much nitrogen increased the tops and leaves without giving any corresponding yield of roots. In Norfolk profitable increases were obtained with up to 4 cwt. of nitrogenous manure. In the West Country the heavy soils gave better response to increased dressings of nitrogen than the lighter ones. As regards time of application it appeared that on the good mixed loams and heavier soils the best results were obtained by applying all the nitrogen before drilling. The suggestion is made that until further information comes to hand the best plan in general is to give half the nitrogen in the seed bed and the remainder immediately

* Ministry of Agriculture, Miscel. Publications, No. 63, *Sugar Beet Demonstrations*. Price 2d. net, post free.

after singling. The bad effect of soil acidity was brought out in these demonstrations, and it is suggested that in such cases growers should use factory lime where this is readily available.

The results of further trials along similar lines in 1928 are now reported (*see this issue, p. 11*). The general showing is in harmony with the previous year's work. Dressings of sulphate of ammonia up to 3 cwt. per acre continued to give profitable increases of sugar. The soundness of applying all or at any rate a part of the sulphate of ammonia in the seed bed as distinct from top dressing was again indicated. Cyanamide gave similar results to sulphate of ammonia at the centres where it was tried in 1928. At the Fenland centres in 1928 the effects of superphosphate and muriate of potash were ascertained. These gave the best result in poor fen soils and on very light peaty soils. On black fenland in high condition, on which 10 cwt. of superphosphate is usually applied to the potato crop, the above manures were ineffective.

Rothamsted Results.—During the last few seasons experiments with sugar beet have been conducted on the heavy soil of Rothamsted and the light soil at Woburn. At Rothamsted in 1926 and at Woburn in 1927 muriate of potash was inferior to 30 per cent. potash salts, but in 1928 these fertilizers were equal at Rothamsted, while at Woburn neither had any effect. On land in high condition, or where a good dressing of nitrogenous manure had been given at sowing time, top dressings of nitrate tended to increase the leaf more than the root. This was observed at both centres in 1926 and 1928. In the latter year at Rothamsted a top dressing of 23 lb. of nitrogen per acre tended to depress the sugar content when 46 lb. of nitrogen had been used in the seed bed. At Woburn in 1928 ammonium chloride did better than sulphate of ammonia. On the heavy soil, roots grown on the ridge yielded better than those grown on the flat, while the reverse was the case on the lighter land.

A Cambridge Report.—An interesting view of the manuring of the crop as commercially grown in 1927 may be derived from a study of a section of a recent report from the Cambridge University Farm Economics Branch.* The area under sugar beet from which the data were collected was no less than 2,303 acres, situated in various parts of the Eastern Counties, and the quantity of manures given to each of the fields under examination was ascertained. It is not possible

* Rept. No. 9, *Sugar Beet in the Eastern Counties*, 1927.

here to set out the final figures in detail, but they will repay careful study because they bring out the actual and relative amounts of the common fertilizers used on sugar beet over this large area; the average size of the dressings; the percentage of the total number of fields receiving each class of manure; and the distribution of each type of artificial fertilizer over light, heavy, and fen soils respectively. The authors point out the very wide variations in the manurial treatment of the crop, and find that it is on the holdings growing a large area of beet that the more definite systems of manuring are adopted.

To obtain a general view of the situation we may consider the total quantity of dung and artificials used in relation to the whole area. We get the following figures as to manures applied per acre of sugar beet (mean of 2,303 acres) in 1927:—

<i>Manure</i>	<i>Dressings per acre</i>	<i>Remarks</i>
Dung	3.6 tons	Only 40 per cent. of the fields received dung.
Bulky organics ..	1.6 cwt.	Mostly fish manures.
Compound fertilizers ..	2.3 "	
Nitrogenous	1.1 "	Expressed as nitrate of soda.
Phosphatic	1.4 "	" " 35% superphosphate
Potassic	2.7 "	" " 14% kainit.

In considering these figures we must bear in mind that in 29 per cent. of the cases the sugar beet followed root crops or bare fallow, and that 24 per cent. of the farms were fen or sewage farms where expenditure on fertilizers could be reduced—a point which is well reflected in the data. Even so, judged by the conventional standard frequently given as a general guide to the manuring of the crop, namely, 10 tons dung, 3-4 cwt. superphosphate, 1½-2 cwt. nitrogenous manure, and 3-4 cwt. kainit or its equivalent, the amounts of fertilizers used appear to be slightly on the small side. This is specially so in view of the small amount of dung used. Actually in a season so unfavourable as 1927 it is doubtful whether heavy manuring would have greatly improved the low average yield of 7.7 tons over the acreage in question.

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PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended March 13th.				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%)	10 12d	10 12d	10 12d	10 12d	13 8
Nitro-chalk (N. 15½%) ..	10 0p	10 0p	10 0p	10 0p	12 11
Sulphate of ammonia :—					
Neutral (N. 20·6%) ..	10 13d	10 13d	10 13d	10 13d	10 3
Calcium cyanamide (N. 20·6%)	9 16s	9 16s	9 16s	9 16s	9 6
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%) ..	..	10 10h	..	..	..
Kainit (Pot. 14%) ..	3 6	2 19	2 19	3 2	4 6
Potash salts (Pot. 30%) ..	5 3	..	4 17	5 1	3 5
" (Pot. 20%) ..	3 15	3 9	3 8	3 12	3 7
Muriate of potash (Pot. 50%) ..	9 17	9 3	9 2	9 0	3 7
Sulphate, " (Pot. 48%) ..	11 19	11 6	11 5	11 5	4 8
Basic Slag (P.A. 15½%)||	2 8c	2 2c	..	2 9c	3 1
" (P.A. 14%)||	2 3c	1 16c	1 16c	2 4c	3 2
" (P.A. 11%)||	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26·27½%) ..	2 10||	2 7||	..	2 5a	1 8
Superphosphate (S.P.A. 16%) ..	3 7	..	3 6	3 6	4 2
" (S.P.A. 13½%) ..	3 2	2 15	3 0	3 0	4 4
Bonemeal (N. 3½%, P.A. 20½%) ..	8 15	8 10	8 12	8 7	..
Steamed bone flour (N. ½%, P.A. 27½-29½%)	5 17b	..	6 10	5 10	..
Burnt Lump Lime ..	1 7k	1 10l	1 11n	2 2m	..
Ground Lime ..	1 14k	..	..	1 17m	..
Ground Limestone ..	1 1k	..	1 8n	2 6m	..
Ground Chalk ..	..	1 6	..	1 11m	..
Slaked Lime ..	..	..	2 14n	3 2m	..

Abbreviations : N.—Nitrogen ; P.A.—Phosphoric Acid ; S.P.A.—Soluble Phosphoric Acid ; Pot.—Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

§ Fineness 80% through standard sieve. a. 85% through standard sieve.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots ; at Bristol, f.o.r. Bridgwater ; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra. Rebate of 1s. per ton will be allowed.

e Delivered in 4-ton lots at purchaser's nearest railway station. Rebate of 1s. 3d. per ton will be allowed.

f F.o.r. Goole.

k 4-ton lots f.o.r. Bristol : ground limestone 98.95% through standard sieve.

l F.o.r. Knottingley.

m 6-ton lots delivered London district, ground limestone 65% through standard sieve Ground limestone, ground chalk and slaked lime in non-returnable bags.

n 6-ton lots delivered Liverpool stations, ground limestone 45% through standard sieve. Ground limestone and slaked lime in non-returnable bags.

p Prices for 2-ton lots. Rebate of 1s. per ton will be allowed.

NOTES ON FEEDING STUFFS

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The Quality of the Protein in Young Pasture Grass.—It is now recognized that the dry substance in young pasture grass contains a large percentage of protein of a highly digestible character. The artificial drying of such young herbage would provide the farmer with a protein concentrate which may, at some future date, come into general use for replacing oil cakes in the winter rations of dairy cows and fattening bullocks. In view of this possibility, it will be of interest to inquire into the quality (or, to employ a more technical term, the biological efficiency) of the protein constituent of young grass, since it is known that proteins from different sources may possess very different values for productive purposes in the farm animal.

The nitrogen in feeding stuffs of plant origin is never present wholly in the form of true protein. A portion invariably occurs as simple nitrogenous substances like ammonium compounds, amides and amino acids. These substances represent the intermediate stages through which the nitrogen taken up from the soil as nitrate must pass before it is elaborated finally into protein. They are usually grouped together under the name of amides. The crude (*i.e.* total) protein of feeding stuffs consists therefore of a mixture of true protein and amides. In the mature fodder plants and seeds the amount of amides is usually very small, whereas in roots and tubers the amides are frequently present in greater amount than the true protein.

It is customary to assume that amides are also abundant in immature green fodders, like young pasture grass, in which the synthesis of true protein from simpler nitrogenous compounds is proceeding with great intensity. This is a point of considerable significance in respect of its bearing on the value to the animal of the crude protein of young grass, since amides are usually regarded as possessing, in comparison with true protein, only a limited value for building up body tissue or milk protein. Before admitting the validity of these assumptions, however, it will be well to consider the following facts.

During the last three or four years more than 50 analyses of samples of young pasture grass have been made in connexion with grassland investigations at Cambridge. The results show that, on an average, the dry matter of such

grass contains 25 per cent. of crude protein, including 3.7 per cent. of amides, and that higher percentages of amides are usually associated with the abundant presence of wild white clover in the herbage. It will be noted, therefore, that the amide content of young grass is not unduly high, especially when it is remembered that meadow hay, on the basis of dry matter, may contain about 2 per cent. of amides. In young green fodders, such as pasture grass, amides represent a purely transient phase in protein synthesis. They do not accumulate in the plant, but, as they appear, undergo more or less prompt transformation into protein. For that reason, their amount in the plant, at any given stage, is never very considerable.

A substantial proportion of the amides in young grass is in the form of amino acids, the substances to which true protein must be broken down during digestion in the animal before absorption into the blood stream. This fraction of the amides represents, in effect, pre-digested protein, and must therefore be of direct value to the animal. That this is the case is proved by the undoubtedly high feeding value of maize silage, a feeding stuff in which a large proportion of the crude protein consists of amides mainly in the form of amino acids. A great deal of evidence might be cited to demonstrate the value of amides in the nutrition of animals. The Scandinavian scientist, Hindhede, has shown, by experiments over long periods, that the digestible portion of potato protein, which is particularly rich in amides, is a valuable type of protein for building up body tissue. Experiments in Denmark have led to the conclusion that when dairy cows are fed on rations containing the correct requirements in respect of energy and protein, almost 90 per cent. of the amides of the food are built up in the animal into milk protein. In Germany, Morgen has proved that if asparagine or ammonium acetate, two typical plant amides, be added to a ration containing sufficient energy but deficient in protein, then they can serve not only for purposes of maintenance, but also for milk production. At a later date, his fellow-countryman, Honcamp, obtained the surprising result that it is possible to replace part of the true protein in the rations of dairy cows by means of an amide like urea without seriously affecting the milk yield of the animal. Sufficient has been written, therefore, to show that the proportion of amides in young pasture grass is by no means excessive, and further, that such amides as are present are capable of productive utilization in the farm animal.

When protein undergoes digestion in the alimentary tract of the animal, it is broken down into its component amino acids, of which about 20 different types are known. The mixture of amino acids is then absorbed into the blood stream and is there utilized for building up new protein in the body tissues or in the mammary secretion. It follows that the best type of food protein for producing live-weight increase in animals should be that which, in respect of the amino acids which it contains, most closely resembles body protein, since the digestion of such protein should yield, in correct proportions, the right kind of amino acids for building up, without waste, new protein in the body. (Incidentally, the reader will recognize in this statement a possible scientific defence of cannibalism.) For this reason, it is clear that feeding stuffs of animal origin supply the best type of protein for producing economical gains of live-weight, and it is to this circumstance that the beneficial effects of feeding stuffs like meat meal and fish meal are partly to be attributed.

Proteins in foods of vegetable origin have, on the other hand, a very different amino acid composition from that of body protein. Indeed, in some instances, certain of the essential types of amino acids, which may be referred to as the corner-stones for building up new protein in the body, are actually absent from such proteins. The recognition of this fact has taught the stock feeder that it is advisable, with herbivora, to feed *mixtures* of feeding stuffs, so that the risk of deficiency in respect of amino acids in the protein supply may be reduced to a minimum.

Chemists have attempted to secure precise information concerning the nutritive value of proteins in different foods by isolating the pure proteins from such sources and determining, by chemical means, the amount and kind of amino acids they contain. The results so far, however, have not been very encouraging, owing, in large measure, to the inadequacy of the methods at the chemist's disposal.

The best test of the biological value of the protein in any given food is obtained by direct experiment on the animal, namely, by measuring the progress which an animal is able to make when subsisting on rations in which the protein supply is derived solely from the feeding stuff under examination. By such tests, the protein in young grass is shown to be of high biological value. Indeed, it would be curious if it were otherwise, since grass is the natural food of herbivora. The latter, in the primitive ages, must have subsisted wholly on grass

herbage, and this circumstance must have been an important factor in determining the course of their evolution. If the protein in such herbage had not proved satisfactory for their particular requirements, it is conceivable that there would be no ruminants on the farm as we know them to-day. Further, pasture herbage usually contains such a complex variety of different species of grasses, each supplying its own individual type of protein, that the risk of deficiency in respect of any one amino acid must be almost infinitesimal.

That young grass contains protein of satisfactory quality is shown by the way young beasts can grow to maturity, and

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	9 14
Maize	81	6.8	10 5
Decorticated ground nut cake	73	41.0	12 10
„ cotton cake	71	34.0	11 10

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2.62 shillings, and per unit protein equivalent, 1.64 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The “food values” which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1928, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	10 4
Oats	60	7.6	8 10
Barley	71	6.2	9 16
Potatoes	18	0.6	2 8
Swedes	7	0.7	0 19
Mangolds	7	0.4	0 19
Beans	66	20.0	10 6
Good meadow hay	37	4.6	5 4
Good oat straw	20	0.9	2 14
Good clover hay	38	7.0	5 11
Vetch and Oat silage	13	1.6	1 17
Barley straw	23	0.7	3 1
Wheat straw	13	0.1	1 14
Bean straw	23	1.7	3 3

DESCRIPTION	Price per qr.		Price per ton	Manu-rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Price per lb. starch equiv.	Pro-tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%	
Wheat, British	—	—	9 18	0 13	9 5	72	2 7	1.38		9.6
Barley, British feeding ..	—	—	9 15	0 10	9 5	71	2 7	1.38		6.2
" Canadian No. 4 Western ..	36 3	400	10 3	0 10	9 13	71	2 9	1.47		6.2
" " feed	34 0	"	9 10	0 10	9 0	71	2 6	1.34		6.2
" American	32 9	"	9 3	0 10	8 13	71	2 5	1.29		6.2
" Persian	35 9	"	10 0	0 10	9 10	71	2 8	1.43		6.2
Oats, English, white	—	—	10 7	0 11	9 16	60	3 3	1.74		7.6
" " black and grey	—	—	10 0	0 11	9 9	60	3 2	1.70		7.6
" Scotch, white	—	—	10 10	0 11	9 19	60	3 4	1.78		7.6
" Argentine	27 0	320	9 8	0 11	8 17	60	2 11	1.58		7.6
" Chilean	28 0	"	9 17½	0 11	9 6	60	3 1	1.65		7.6
" German	30 6	"	10 13	0 11	10 2	60	3 4	1.78		7.6
Maize, American	42 6	480	9 18½	0 10	9 8	81	2 4	1.25		6.8
" Argentine	45 3	"	10 12	0 10	10 2	81	2 6	1.34		6.8
Beans, English, winter	—	—	10 13½	1 5	9 8	66	2 10	1.52		20
" Chinese	—	—	11 12½	1 5	10 7	66	3 2	1.70		20
Peas, English, blue	—	—	14 0½	1 2	12 18	69	3 9	2.01		13
" Japanese	—	—	20 10½	1 2	19 8	69	5 7	2.99		18
Dari	—	—	11 0*	0 12	10 8	74	2 10	1.52		7.2
Millers' offals—										
Bran, British	—	—	7 17	1 3	6 14	42	3 2	1.70		10
" broad	—	—	9 5	1 3	8 2	42	3 10	2.05		10
Middlings, fine, imported ..	—	—	9 2	0 18	8 4	69	2 5	1.29		12
" coarse, British	—	—	7 15	0 18	6 17	58	2 4	1.25		11
Pollards, imported	—	—	7 15	1 3	6 12	60	2 2	1.16		11
Meal, barley	—	—	10 12	0 10	10 2	71	2 10	1.52		6.2
" maize	—	—	10 15	0 10	10 5	81	2 6	1.34		6.8
" " South African	—	—	10 10	0 10	10 0	81	2 6	1.34		6.8
" " germ	—	—	10 5	0 16	9 9	85	2 3	1.20		10
" locust bean	—	—	9 10	0 8	9 2	71	2 7	1.38		3.6
" bean	—	—	12 15	1 5	11 10	66	3 6	1.87		20
" fish	—	—	19 10	3 9	16 1	53	6 1	3.26		48
Maize, cooked flaked	—	—	12 10	0 10	12 0	85	2 10	1.52		8.6
" gluten feed	—	—	10 15	1 0	9 15	76	2 7	1.38		19
Linseed cake, English, 12% oil ..	—	—	13 17	1 10	12 7	74	3 4	1.78		25
" " " 9% "	—	—	13 5	1 10	11 15	74	3 2	1.70		25
" " " 8% "	—	—	13 0	1 10	11 10	74	3 1	1.65		25
Soya bean	—	—	12 5½	2 2	10 3	69	2 11	1.56		36
Cottonseed cake, English—										
Egyptian, 4½% "	—	—	8 0	1 9	6 11	42	3 1	1.65		17
" Egyptian, 4½% "	—	—	7 17	1 9	6 8	42	3 1	1.65		17
Decorticated cottonseed meal ..	—	—	12 5*	2 3	10 2	74	2 9	1.47		35
Coconut cake, 6% oil	—	—	11 5	1 5	10 0	79	2 6	1.34		16
Ground-nut cake, 6.7% oil	—	—	10 5½	1 8	8 17	57	3 1	1.65		27
Decorticated ground-nut cake, ..	—	—	12 10½	2 3	10 7	73	2 10	1.52		41
6.7% oil	—	—	10 0*	0 18	9 2	75	2 5	1.29		17
Palm kernel cake, 4½-5½% " ..	—	—	10 10*	0 18	9 12	75	2 7	1.38		17
" " meal, 4½% "	—	—	9 7	0 19	8 8	71	2 4	1.25		17
" " meal, 1% "	—	—	8 17	1 0	7 17	49	3 2	1.70		13
Brewers' grains, dried ale	—	—	8 7	1 0	7 7	49	3 0	1.61		13
" " " porter	—	—	7 15*	1 8	6 7	43	2 11	1.56		16
Malt culms	—	—	—	—	—	—	—	—		—

* At Bristol.

† At Hull.

‡ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of February and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.43d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 4d.; P₂O₅, 3s. 10d.; K₂O, 3s. 5d.

store animals be fattened, on pasture herbage alone. It is a commonplace with the farmer that, during the flush growth of grass, a dairy cow requires no supplementary food for maintenance and the first 2 or 3 gal. of milk. Indeed, cases are known both in this country and on the Continent where cows yielding as much as 5 gal. of milk per day are able to maintain their milk yield on well-managed pastures without the help of any extra food. Moreover, during the winter of 1927-28, on the University Farm at Cambridge, artificially dried young pasture grass was used successfully to replace the cake and meal mixtures in the rations of dairy cows and fattening bullocks. Although the isolation and examination of the protein constituents of herbage fodders is possessed of much scientific interest, and although the results of such investigation may ultimately prove of practical utility, it must nevertheless be admitted that the skill of the chemist is scarcely needed to demonstrate the outstanding feeding quality of the protein in young grass. The experience of generations of farmers and graziers has supplied the necessary proof. It is safe to conclude that young leafy pasturage not only supplies an abundance of protein, but also that its protein possesses the twin characteristics of high digestibility and of high biological value for flesh and milk production in the animal.

* * * * *

MISCELLANEOUS NOTES

THE trials which are arranged each year by the Ministry with the object of testing new varieties of potatoes for immunity from Wart Disease were again conducted

Trials of Potatoes in 1928 on the farm of the National for Immunity from Institute of Agricultural Botany, Orms-Wart Disease, 1928 kirk, Lancashire. The actual field operations and the taking of records were carried out by Mr. Harold Bryan, B.Sc., and Mrs. McDermott, of the Institute, but the trials were conducted on a plan approved by the Ministry.

Twenty-seven stocks were included in the second and subsequent year's tests, and of these one foreign variety proved susceptible to Wart Disease. Of the 57 entries for the first year's tests, 15 became infected; 11 proved to be synonyms of existing varieties; 4 were too poor to judge, and 42 were distinct varieties or true to name.

As in previous years, the results of the trials have been considered by a small committee composed of representatives

of the Ministry of Agriculture and Fisheries, the Department of Agriculture for Scotland, and the Ministry of Agriculture for Northern Ireland, and co-ordinated with the results of the trials carried out by the two latter Departments at Philipstoun and Kilkeel respectively.

The Committee recommended the approval of 16 new varieties, but only five of these have actually been added to the approved list. In the remaining cases inclusion has been postponed until such time as the raisers have intimated that the varieties have actually been or will shortly be introduced into commerce. Descriptions are given below of the five new varieties, together with that of one variety which was approved as the result of the 1927 trials, and which is now being introduced into commerce.

The findings of the Potato Synonym Committee of the National Institute of Agricultural Botany have been accepted by the Ministry where recommendations as to the classification of new varieties, as synonymous with existing varieties, have been made by that Committee.

A list of the names of varieties which have been approved in recent years as immune from Wart Disease, and those of the older approved immune varieties which are known to the Ministry to be in general cultivation in England and Wales, may be obtained on application to the Ministry.

Early Variety :

"Arran Crest."

- | | |
|-------------------|--|
| Sprout .. | Pink. |
| Tuber .. | Round ; skin white ; flesh white ; eyes medium. |
| Haulm and Foliage | Low-growing, open, spreading, moderately vigorous ; leaflets dark green, soft, glossy, long and narrow, petioles long ; secondary leaflets large, not numerous ; leaf open ; general bronzing of the stems, especially at the base ; wings straight. |
| Flowers .. | White, rare ; buds drop off without opening. |

Second Early Variety :

"Alannah."

- | | |
|-------------------|--|
| Sprout .. | Pink. |
| Tuber .. | Oval to oblong ; skin white ; flesh white ; eyes medium, eyes on sides of tuber having long eyebrows. |
| Haulm and Foliage | Medium height, spreading vigorous ; stems branching, tinged red-purple ; branches rigid, wings slightly waved at the tops ; leaf open and rigid ; leaflets broad, medium to dark green and bright. |
| Flowers .. | Creamy white, large and profuse ; anthers often loose ; buds dark ; berries occur frequently. |

Early Maincrop Varieties :**“ Best of the Bunch.”**

- Sprout .. Pink.
 Tuber .. Oval ; skin white ; flesh white ; eyes shallow.
 Haulm and Moderately vigorous, spreading ; leaflets dark
 Foliage grey-green, dull, short and narrow ; secondary
 leaflets small ; stems green, with pink tinge in
 the midribs and petioles ; wings straight.
 Flowers .. White.

“ Rathmore.”

- Sprout .. Faint pink.
 Tuber .. Kidney ; skin white ; flesh white ; eyes shallow.
 Haulm and Medium height, spreading ; leaf and leaflets flat,
 Foliage open and smooth, ashy-green.
 Flowers .. None observed.

Late Maincrop Varieties :**“ Dunbar Cavalier.”**

- Sprout .. Pink.
 Tuber .. Oval ; skin white, rough ; flesh white ; eyes and
 eyebrows pink ; eyes shallow, eyes on sides
 of tuber having long eyebrows.
 Haulm and Upright, tall ; stems tinged red-purple ; leaf open ;
 Foliage midrib of leaves pink at the base and at the
 base of the leaflet stalks ; leaflets medium to
 dark green.
 Flowers .. Red-purple, tipped white, profuse ; berries occur
 freely ; buds dark.

‘ Quality.’

- Sprout .. Pink.
 Tuber .. Oval ; skin white ; flesh white ; eyes shallow.
 Haulm and Spreading ; of medium height to tall ; stems
 Foliage branching ; leaf long ; leaflets medium green,
 glossy, large, end pair overlapping the terminal.
 Flowers .. White ; buds dark.

* * * * *

PRICES of agricultural produce in February averaged 44 per cent. above the level of the base years 1911-13, or 1 point below the previous month's

The Agricultural figure, as compared with a fall of 2
Index Number points to 43 per cent. above pre-war in
 the corresponding period a year ago.

Cereals and fat pigs showed an increase in price, potatoes and hay were a little cheaper, while for fat cattle and sheep, which maintained their January price levels, the index numbers declined, owing to a rise in the base period.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1924 :—

		Percentage increase compared with the average of the corresponding month in 1911-13					
Month		1924	1925	1926	1927	1928	1929
January	..	60	71	58	49	45	45
February	..	61	69	53	45	43	44
March ..	..	57	66	49	43	45	—
April ..	..	53	59	52	43	51	—
May ..	..	57	57	50	42	54	—
June ..	..	56	53	48	41	53	—
July ..	..	53	49	48	42	45	—
August..	..	57	54	49	42	44	—
September	..	61	55	55	43	44	—
October	..	66	53	48	40	39	—
November	..	66	54	48	37	41	—
December	..	65	54	46	38	40	—

Grain.—Wheat and barley each became dearer in February by 3d. per cwt. and the relative index numbers rose by 1 and 2 points respectively to 31 and 28 per cent. above 1911-13 as against 29 and 34 per cent. in February last year. Oats were 6d. per cwt. higher and the index number rose by 2 points to 36 per cent. above pre-war as compared with 42 per cent. a year ago.

Live Stock.—Quotations for fat cattle and sheep were practically unchanged on the month, but owing to an upward movement occurring in this period in 1911-13, the index numbers fell in each case, that for cattle being 1 point lower at 34 per cent. above pre-war, and for sheep 11 points down at 56 per cent. The prices of fat pigs, which have been steadily rising since last November, rose rather more sharply during February, baconers becoming 11d. and porkers 10d. per stone dearer. The index figure for the former was 10 points higher at 50 per cent. above the pre-war level, while for porkers it increased by 8 points to 60 per cent., these figures being 12 and 18 points respectively above those of February, 1928. Dairy cows again averaged 33 per cent. above pre-war, while store cattle also were unchanged at 23 per cent. Store sheep were about 3s. per head dearer on the month, but the index number declined by 2 points. Values for store pigs also rose by about 3s. per head and the index figure advanced to 56 per cent. above the level of February, 1911-13.

Dairy and Poultry Produce.—Milk was unaltered either in price or index number. Butter, however, became very slightly

cheaper, although the index figure showed no change, while in the case of cheese a repetition of the previous month's average price resulted in a fall of 4 points to 74 per cent. above 1911-13. Eggs were further reduced by 1d. per dozen, but as the downward movement was proportionately more pronounced in the base period, the index number appreciated 12 points to 68 per cent. above pre-war, which compares with a fall of 44 points to 33 per cent. a year ago. Poultry as a whole averaged 41 per cent. in excess of 1911-13, as against 45 per cent. during the preceding month.

Other Commodities.—Wool became slightly cheaper during February and the index figure declined by 3 points to 69 per cent. above the level of the base period. Quotations for potatoes fell by 1s. per ton and the index number by 2 points, while similar reductions occurred in the case of hay. The severe weather conditions during February caused prices of vegetables to rise sharply and the index figure at 79 per cent. above 1911-13 was 19 points above the figure for the previous month.

Index numbers of different commodities during recent months and in February, 1927 and 1928, are shown below :—

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1927	1928			1929	
	Feb.	Feb.	Nov.	Dec.	Jan.	Feb.
Wheat	60	29	31	31	30	31
Barley	37	34	25	24	26	28
Oats	16	42	27	29	34	36
Fat cattle	30	32	31	27	35	34
Fat sheep	44	56	53	50	67	56
Bacon pigs	63	38	24	26	40	50
Pork pigs	75	42	33	36	52	60
Dairy cows	26	29	38	34	33	33
Store cattle	30	25	20	21	23	23
Store sheep	48	44	53	49	59	57
Store pigs	125	41	31	30	52	56
Eggs	62	33	51	37	56	68
Poultry	39	39	47	45	45	41
Milk	62	66	71	71	70	70
Butter	40	47	52	50	53	53
Cheese	36	59	78	79	78	74
Potatoes	94	71	53	45	31	29
Hay	—2*	12	4	8	6	4
Wool	32	62	66	66	72	69

* Decrease.

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland in the three months ended December, 1928, compared with the corresponding period in 1927. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	October to December 1928		October to December 1927	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	16	2,690	46	6,570
Belgium	10	109	28	508
Brazil	1	500	12	1,400
Chile	5	912	2	590
Colombia	9	1,320	10	1,584
Russia	106	6,919	0	0
British India	11	1,370	5	185
Canada	115	11,215	75	5,520
Irish Free State ..	385	7,898	756	11,905
Kenya	45	2,293	19	682
Union of South Africa ..	73	5,585	0	0
Other countries	29	1,960	24	1,732
Total	805	42,771	977	30,676
SHEEP AND LAMBS				
Argentina	442	12,844	379	9,710
Brazil	26	720	43	1,215
Chile	48	2,843	47	1,670
Russia	556	5,247	0	0
United States of America	0	0	96	1,183
Uruguay	172	3,853	73	1,196
Canada	146	2,905	63	1,540
Irish Free State ..	439	3,011	201	1,204
Kenya	24	291	8	190
Other countries	59	771	22	257
Total	1,912	32,485	932	18,165
SWINE				
Argentina	6	356	3	46
Brazil	12	300	0	0
Japan	3	252	8	428
Lithuania	10	250	0	0
Poland	0	0	13	340
Russia	19	975	0	0
Falkland Islands ..	35	105	0	0
Irish Free State ..	42	494	234	387
Kenya	10	147	1	50
Other countries	40	771	20	535
Total	177	3,650	279	1,786

At the Ideal Home Exhibition, held at Olympia from February 26 to March 23, the Empire Marketing Board assumed responsibility for a large section, and the Ministry, in collaboration with the National Farmers' Union and other organizations, arranged a display of home produce. This took an entirely new form, as will be seen from the photograph opposite. The novelty of the lighting effects of this display attracted much attention from the numerous visitors to the exhibition and undoubtedly achieved its purpose of bringing to notice the claims of home produce.

In addition, there was a big display of National Mark eggs and cartons, together with a Textophote machine, which showed in rotation 12 pictures illustrating the egg industry.

On this occasion also, for the first time, the experiment was made of selling samples of home produce labelled as such but not bearing the brands of individual firms. Three commodities were selected: crustless cheese, jam, and special cartons holding three eggs and bearing the National Mark. Sales proved very satisfactory and indicate the interest which is now being taken in home-grown foodstuffs.

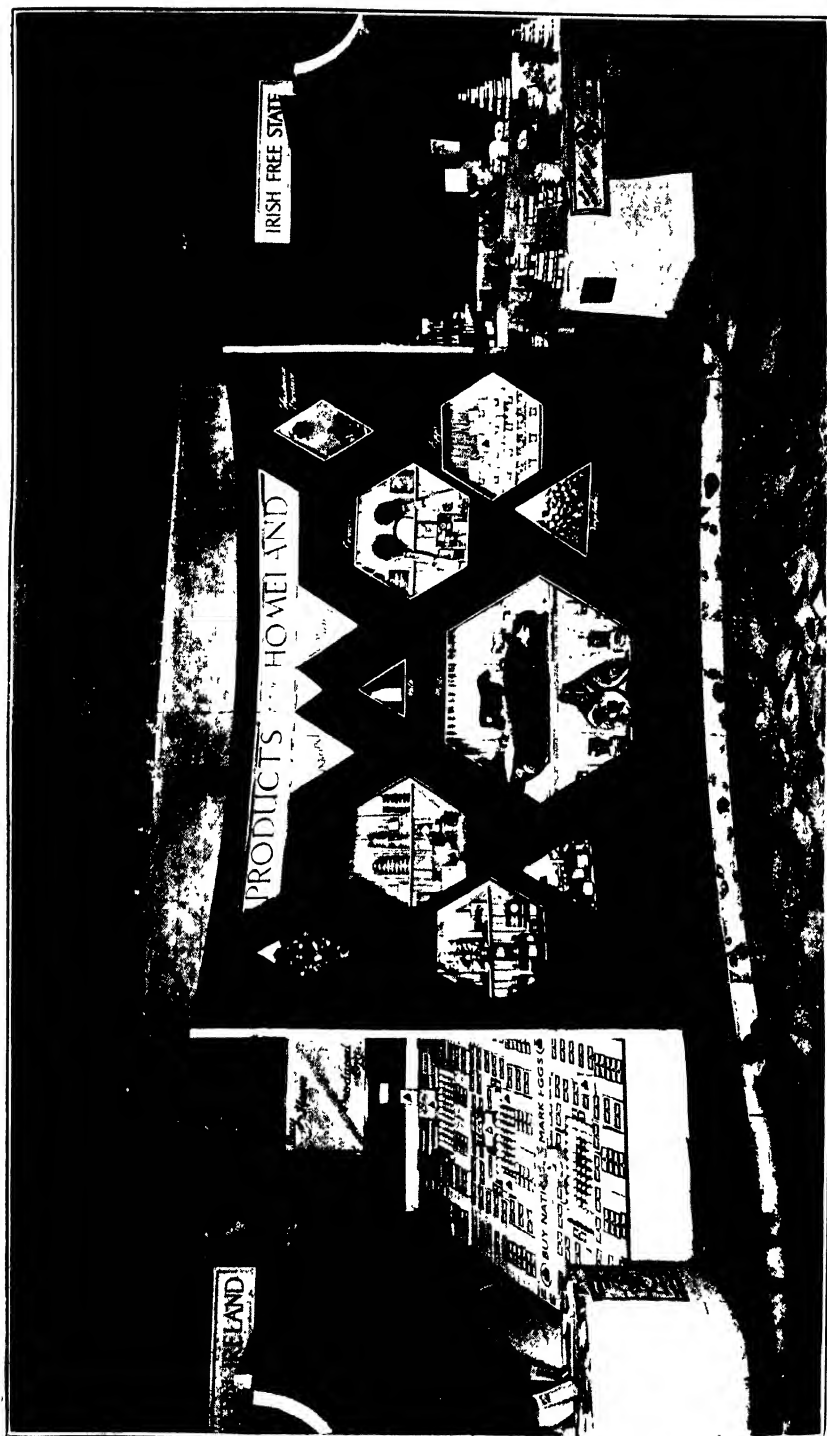
* * * * *

THIS Society was formed in 1923. During the first year of the Society's operations, a membership of 252 enabled it to put 65,000 fleeces on the market.

Southern Wool Growers Limited As will be seen from the following table, a notable increase in membership was secured in the following year, resulting in an increase of 100,000 in the number

of fleeces marketed: membership has increased steadily since. The increase in overhead charges in 1928 is accounted for by the fact that, in that year, the Society commenced the repayment of a capital loan granted by the Ministry under its scheme for assisting the establishment of co-operative marketing societies.

Year		Number of Members	Capital £	Fleeces	Net Sales £	Overhead Charges (per lb.)
1924	..	252	1,395	65,000	36,646	1½d.
1925	..	667	3,915	165,000	56,402	1d.
1926	..	734	5,230	152,000	45,279	1d.
1927	..	798	5,671	150,000	49,046	1d.
1928	..	903	5,864	150,000	55,765	1½d.



A full description of the working of the Society is given in the Ministry's Report on Wool Marketing in England and Wales (Economic Series No. 7). This Report is obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 6d. net (7d. post free).

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THE Ministry has decided to continue during a further season the scheme which was inaugurated in 1924 for the improvement of milch goats kept by **Stud Goat Scheme**, cottagers, smallholders and others of similar position. It will be remembered that, under this scheme, persons in the above-mentioned categories are enabled to obtain the services of first-class stud goats for breeding purposes at a maximum fee of 5s. per service. During the season just concluded 1,844 services have been given, of which 1,719 qualified for premium, the corresponding figures for the 1927-28 season being 1,609 and 1,491 respectively.

In 1929-30, as in previous years, a grant will be made to the British Goat Society to cover the payment of premiums and certain administrative expenses. No stud goat can be accepted which has not been entered, or is not considered eligible for entry, in the Society's Herd Book, but applicants need not be members of the Society. Owners who desire to have their stud goats registered under the scheme should apply, not later than April 15, direct to the Honorary Secretary at 10 Lloyd's Avenue, E.C. 3, who will be pleased to furnish full particulars and application forms.

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Foot-and-Mouth Disease.—An outbreak was confirmed on February 27 at Martin, near Lincoln, Lincs (Kesteven), and the usual restrictions were applied to an area of approximately 15 miles radius round the infected premises, in close proximity to which two further outbreaks were confirmed on March 2 and 3.

No further outbreaks having occurred in the following infected areas referred to in the March issue of this JOURNAL, the restrictions were withdrawn on the dates mentioned: Northampton, February 27; Yorks, North Riding, March 1; Cambridge, March 15; and Lancashire, March 17.

Nineteen outbreaks have been confirmed since January 1 last, located in 7 counties, and involving the slaughter of 434 cattle, 819 sheep, 444 pigs and 4 goats,

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on February 19, 26 and 28, and March 12, 1929, at 7 Whitehall Place, London, S.W. 1.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying into effect the Committee's decisions :—

Devonshire.—Continuing the operation of the existing minimum and overtime rates of wages until March 25, 1930. The minimum rate in the case of male workers of 21 years and over is 32s. 6d. per week of 52 hours from April 22 to October 6 and 50 hours from October 7 to April 21, with overtime at 8½d. per hour on weekdays and 10d. per hour on Sundays and for overtime employment on the hay and corn harvests. In the case of female workers of 20 years of age and over the minimum rate is 5d. per hour for all time worked.

Durham.—Continuing the operation of the existing minimum and overtime rates of wages until May 13, 1930. The minimum rates in the case of male workers of 21 years of age and over are : for horsemen who are householders 32s. per week of 50 hours with, in addition, 7s. per week to cover all time customarily spent in attention to horses ; for horsemen who are not householders and who are not boarded and lodged 31s. per week of 50 hours with, in addition, 3s. 6d. per week to cover all time customarily spent in attention to horses ; for horsemen who are boarded and lodged 31s. per week of 50 hours and any additional time customarily spent in attention to horses ; for stockmen or shepherds who are householders 43s. ; for stockmen or shepherds who are not householders and who are not boarded and lodged 36s. 10½d., and for stockmen or shepherds who are boarded and lodged 35s. per week, in each case for such hours as are customarily spent in attention to stock. The minimum rate for other male workers of 21 years of age and over is 31s. per week of 50 hours, except in the case of casual workers, where the rate is 6d. per hour. The overtime rate for all classes of male workers other than casual workers is 10d. per hour on Sunday and after 12 noon on Saturday, and 9d. per hour for all other overtime employment. In the case of female workers of 18 years of age and over the minimum rate is 2s. 6d. per day of 8 hours, with overtime at 4d. per hour.

Essex.—Fixing minimum and overtime rates of wages to continue in operation until April 19, 1930. The minimum rates in the case of male workers of 21 years of age and over are 30s. per week of 41½ hours in the weeks in which Easter Monday and Whit Monday fall, 50 hours in any other week in summer, 39½ hours in the week in which Christmas Day falls and 48 hours in any other week in winter, with overtime at 9d. per hour on weekdays (including Easter Monday and Whit Monday), and at 10d. per hour on Sundays and on Christmas Day. In the case of female workers of 21 years of age and over the minimum rate is 5½d. per hour for all time worked.

Herefordshire.—Varying the existing minimum and overtime rates of wages, and to continue in force until April 30, 1929. The minimum rates in the case of male workers of 21 years of age and over are for bailiffs, waggoners, stockmen or shepherds 36s. per week (including Sunday) for all time necessarily spent on the immediate care of animals not exceeding 60 hours, and other male workers 31s. per week of 54 hours. The overtime rate for

all classes of male workers is 9d. per hour, except for employment on Good Friday where the worker has completed in that week less than the full number of hours in respect of which the minimum weekly wage is payable, when the overtime rate is 2d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 4½d. per hour with overtime at 6d. per hour except for employment on Good Friday where a whole-time worker has completed less than 46½ hours in that week, when the overtime rate is 1½d. per hour.

Kent.—Fixing minimum and overtime rates of wages to continue in force until March 1, 1930. The minimum rates in question, in the case of horsemen, stockmen and shepherds of 21 years of age and over are 33s. per week of 42½ hours in the weeks in which Good Friday and Christmas Day fall and 52 hours in any other week with, in addition, 8d. per hour for employment on customary duties in excess of those hours but not exceeding 60 in any week (including Sunday), overtime being payable at 9d. per hour, except in the case of employment on other than customary duties on Sundays, Good Friday and Christmas Day, when the overtime rate is 10d. per hour. The minimum rates in the case of other male workers of 21 years of age and over are 32s. 6d. per week of 42½ hours in the week in which Good Friday falls, 52 in any other week in summer, 39 in the week in which Christmas Day falls, and 48 in any other week in winter, with overtime at 9d. per hour on weekdays and 10d. per hour on Sundays, Good Friday and Christmas Day. In the case of female workers of 18 years of age and over the minimum rate is 5½d. per hour, with overtime at 6½d. per hour on weekdays and 7d. per hour on Sundays, Good Friday and Christmas Day.

Middlesex.—Continuing the operation of the existing minimum and overtime rates of wages until February 28, 1930. The minimum rates applicable to male workers of 21 years of age and over are 41s. 3d. per week of 60 hours in the case of stockmen; 38s. 6d. per week of 56 hours in the case of carters; 8½d. per hour in the case of casual workers, and 34s. 4½d. per week of 50 hours in summer and 33s. per week of 48 hours in winter in the case of all other workers, with overtime in each case at 10½d. per hour. The minimum rates for female workers of 18 years of age and over are 30s. per week of 60 hours in the case of workers employed on the duties of stockmen; 28s. per week of 56 hours in the case of carters; 6d. per hour in the case of casual workers, and 25s. per week of 50 hours in summer and 24s. per week of 48 hours in winter in the case of all other workers, overtime being payable in all cases at 7½d. per hour.

Monmouthshire.—Fixing minimum and overtime rates of wages to continue in force until March 15, 1930. The minimum rate in the case of male workers of 21 years of age and over is 32s. per week of 54 hours in summer (instead of 52 hours as at present) and 50 hours in winter, with overtime at 9½d. per hour on weekdays and 11½d. per hour on Sundays and on Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and Boxing Day. In the case of female workers of 17 years of age and over the minimum rate is 6d. per hour for all time worked.

Norfolk.—1. Fixing minimum and overtime rates of wages to operate until December 28, 1929. The minimum rates in the case of male workers of 21 years of age and over are 30s. per week of 50 hours in summer, 40 hours in the week in which Christmas Day falls, and 48 hours in any other week in winter with, in addition, in the case of teamsmen, cowmen, shepherds and yardmen, 5s. 6d.

per week, and in the case of sheep-tenders and bullock-tenders 4s. 6d. per week, in respect of all employment on the duties of feeding, cleaning, milking, bedding down or mucking out stock, or other similar duties in connexion with the immediate care of animals. The overtime rates in the case of male workers of 21 years of age and over are 9d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour, with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays.

2. Fixing special minimum and overtime rates of wages for the employment of male workers during the corn harvest in 1929. In the case of workers of 21 years of age and over employed throughout the harvest the wage payable in respect of the harvest is an inclusive sum of £11 0s. 0d. In the case of workers who are not employed for the full harvest period special differential rates have been fixed for overtime employment on the corn harvest, the rate in the case of workers of 21 years of age and over being 9½d. per hour.

Sussex.—Fixing minimum and overtime rates of wages to continue in force until April 12, 1930. The minimum rates in the case of horsemen, cowmen, stockmen or shepherds of 21 years of age and over are 36s. per week of 50 hours in the weeks in which Good Friday, Whit Monday and Christmas Day fall, and 58 hours in any other week. In the case of other male workers of 21 years of age and over the minimum rate is 31s. per week of 44 hours in the weeks in which Good Friday and Whit Monday fall, 52 hours in any other week in summer, 40 hours in the week in which Christmas Day falls, and 48 hours in any other week in winter. The overtime rates for all classes of male workers of 21 years of age and over are 9d. per hour on weekdays and 10½d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour, with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays.

Worcestershire.—Fixing minimum and overtime rates of wages to continue in force until March 1, 1930. The minimum rate in the case of male workers of 21 years of age and over is 30s. for a week of 50½ hours in summer (instead of 53 hours as at present) and 48 hours in winter, with overtime at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour (instead of 4½d. per hour as at present), with overtime at 5½d. per hour.

Glamorgan.—Continuing the operation of the existing minimum and overtime rates of wages until March 1, 1930. The minimum rate in the case of stockmen, cattlemen, cowmen, horsemen, shepherds or bailiffs of 21 years and over is 38s. per week of 60 hours, with overtime at 11d. per hour, and in the case of other male workers of 21 years of age and over 34s. per week of 52 hours in summer and 48 hours in winter, with overtime at 10d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over, the minimum rate is 6d. per hour, with overtime at 7d. per hour on weekdays and 7½d. per hour on Sundays.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Enforcement of Minimum Rates of Wages.—During the month ending March 15, legal proceedings were instituted against seven employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board.

Particulars of the cases are as follows :—

County	Court	Fines		Costs		Arrears of wages		No. of workers involved
		£	s. d.	£	s. d.	£	s. d.	
Durham ..	Durham ..	*		1	2 0	6	9 9	1
Lines ..	Lindsey ..	12	0 0	—		25	14 0	3
Yorks, N.R.	Richmond..	*		0	5 0	34	0 0	1
„ W.R.	Goole ..	2	0 0	—		10	12 0	1
„ „	Wetherby ..	2	0 0	—		19	1 4	1
Cardigan ..	Tregaron ..	—		—		—		1
Glamorgan .	Swansea ..	—		2	2 0	15	0 0	1
		£16	0 0	£3	9 0	£110	17 1	9

* Dismissed under the Probation of Offenders Act.

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APPOINTMENTS : CHANGES AND CORRECTIONS

HONOURS

Dr. R. A. FISHER and Dr. A. D. IMMS, of the Rothamsted Experimental Station, Harpenden, Herts, have been elected Fellows of the Royal Society.

Dr. FISHER has also been awarded the Weldon Prize of the University of Oxford for high distinction in Biological Science.

In the New Year's Honours List, Sir THOMAS H. MIDDLETON, K.B.E., C.B., LL.D., of the Development Commission, late Member of the Royal Commission on Agriculture in India, is created a Knight Commander of the Most Eminent Order of the Indian Empire (K.C.I.E.).

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Somerset : Mr. W. M. Gair has been appointed to the post of Assistant Instructor in Poultry-keeping.

Sussex East : Mr. O. R. Stevenson, N.D.P., has been appointed to the post of Instructor in Poultry-keeping.

Yorkshire (University of Leeds Department of Agriculture) : Mr. J. Glen, B.Sc., N.D.A., N.D.P., has been appointed Assistant Lecturer in Dairy Husbandry, *vice* Mr. A. McVicar, B.Sc., N.D.A., N.D.D.

Mr. R. G. Ferguson, B.Agr., has been appointed Demonstrator in Agricultural Botany, *vice* Mr. W. A. Jacques, B.Sc.

COUNTY AGRICULTURAL EDUCATION STAFFS : WALES

Denbigh : Miss M. A. Inglis, N.D.D., has resigned the post of Instructress in Dairying.

Mr. O. R. Stevenson, N.D.P., has resigned the post of Instructor in Poultry-keeping.

Merioneth : Mr. Gwilym Evans, B.Sc., has resigned the post of Instructor in Agriculture and Rural Science.

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., ENGLAND

Midland Agricultural and Dairy College, Sutton Bonington

Mr. L. M. Walker, B.Sc., has been appointed Lecturer in Engineering and Surveying, *vice* Mr. G. R. Hunter, B.Sc. (deceased).

NOTICES OF BOOKS

The N.F.U. Year Book for 1929. Pp. 508. (London: The National Farmers' Union, 45 Bedford Square, W.C. 1. Price 5s.)

The farmer's "Blue Book," as it is popularly called, is sufficiently well known to need no introduction here. The current edition, as hitherto, is packed with useful information for the agriculturist; and there can be few subjects affecting his dealings with external authorities on which it fails to give him guidance and advice. There is, for example, a useful summary of legislation in 1928 affecting agriculture—itsself a valuable section of the Year Book. There are also complete memoranda on the various other enactments relating to farmers and farming, with very detailed information on such matters as tenancy, rates and taxes, valuation, tithes, wages, licences, railway rates, weather conditions last year, and so on. A large part of the book is taken up by the domestic affairs of the Union, a statement of its Record, the Report of the Council for 1928, constitution, and lists of officers, etc. A very admirable feature is the first section, devoted to Agricultural Education and Research, which includes, in addition to much general information about educational facilities and institutions, progress reports from certain of the Research Stations; a review, by Professor S. H. Gaiger, of agricultural research work abroad; and a survey, by Sir John Russell, of "Agricultural Science and Arable Farming in 1928."

Literature on Agricultural Meteorology.—The Ministry has issued a bibliography of literature on agricultural meteorology for the two years October, 1926, to September, 1928. It contains references to nearly 400 papers. This is the second bibliography of the kind, the first having been issued two years ago and relating to the two-year period, October, 1924, to September, 1926. The classification in these bibliographies is carried out according to meteorological elements. Summaries of many of the papers to which references are given have appeared in the Monthly Crop Weather Report issued by the Ministry, and the bibliographies include references to these summaries.

Copies of these bibliographies can be obtained free on request.

An Economic and Financial Analysis of Fifteen East Anglian Farms, 1926-27. By R. McG. Carslaw, M.A. (Dip.Agric.Econ.), and W. H. Kirkpatrick, C.D.A. (Glas.). (Cambridge: W. Heffer & Sons, Ltd. 1928. Price 1s. net.)

The reports of the Farm Economics Branch of the University of Cambridge have already been made familiar to the readers of this JOURNAL, and it is perhaps hardly necessary to examine the contents of this publication (Report No. 10) in detail. Perhaps it may be said that this Report would have been issued at an earlier date, if it had not been delayed by the necessity for concentrating on the Sugar Beet inquiry, the results of which are contained in Report No. 9 noticed in last month's (March) issue.

The present Report forms an analysis of the fourth year of costing of the Michaelmas entry farms which have been dealt with, and completes the preliminary work necessary to the preparation of a comprehensive report covering the costing of these farms during the whole of this time, which it is proposed to publish later.

The analysis of the profits and losses made by the farm is illustrated by comprehensive tables comparable with those contained in the similar reports already issued, but only 10 of the original 14 farms reviewed in Report No. 1 are dealt with in that at present under notice, and a warning is extended that this point should be

kept in mind when studying the five tables with which this report is concluded.

It is of interest to note that the writers state that, in their opinion, there is no sweeping internal reorganization or legislative measure which could place agriculture definitely in a prosperous position for the future.

Permanent and Temporary Pastures. By Martin J. Sutton. Revised and extended by his son, Martin H. F. Sutton, F.L.S., in collaboration with John Percival, M.A., Sc.D., F.L.S. 9th Edition. (London: Simpkin Marshall, Ltd. 1929. Price, cloth, 10s. 6d.)

All interested in the laying down and improvement of grassland will welcome this new edition of a standard work on the question. In revising and extending his father's book, Mr. Martin H. F. Sutton has collaborated with Professor John Percival, and between them they have succeeded in presenting a very readable story of progress and development in a subject that is earnestly engaging the attention of students and farmers at the present time.

The chapter on drainage is an excellent exposition of the subject, somewhat marred, perhaps, by the omission of all reference to mole drainage, often the only possible method to-day of dealing with heavy, waterlogged land. In referring to the formation of new pastures, the authors plead convincingly for a more widespread trial of the temporary ley, even in districts generally believed to be unsuitable. This can be heartily endorsed. In general, it is probably no more difficult to establish a ley for two or more years than for one year. It is mainly a matter of tilth, seed-selection, and judicious management. A fine, firm, winter-made tilth may, in certain cases, be preferable to a loose, lumpy, spring tilth, and drilling is often more satisfactory than broadcasting. Knowledge of the habits and propensities of the different species, and of means for encouragement and control, has advanced greatly in recent years. The use of wild white clover and other improved species, suitably blended according to circumstances, has added enormously to the potentialities of the soil for pasturage. In the drier situations the effects of drought may be largely combated by laying up a field for hay, and depending on it for grazing at seasons when lack of moisture is not a limiting factor.

In the matter of freedom from weeds before sowing down, the authors set up a very high standard, perhaps unnecessarily so, if the effect is to deter farmers from the project rather than face the expense. It should be remembered that many kinds of weeds do not thrive in competition with the best pasture plants, and that in the mower, properly used, the farmer possesses an effective and expeditious means of keeping most troublesome weeds under control.

Co-operative Marketing of Agricultural Products. By Michael Murphy, M.A., B.Com. Agricultural Bulletin No. 3, University of Cork. (Cork: Educational Co. of Ireland, Ltd.; London: Longmans, Green & Co., Ltd. 1928. Price 3s. 6d.)

This is an appeal for large-scale organizations for the co-operative marketing of agricultural produce. The writer has studied carefully the literature on the subject and has drawn largely, but with discretion, from American experience. The sequence of the Report is logical and clear.

One chapter, that on the membership contract, is, in particular, deserving of careful reading by all who desire a full knowledge of one of the most serious problems of co-operative marketing.

ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

Northern Ireland, Ministry of Agriculture.—The Agricultural Output of Northern Ireland, 1925. [Cmd. 87.] (84 pp.) Belfast: H.M. Stationery Office, 1928, 2s. 6d. [31 (416).]

Brdlik, V.—Encyclopédie Tchecoslovaque: Agriculture. (882 pp.+3 pl.) Paris: Bossard; Prague: Orbis, 1928. [63(03) 63 (437).]

Möller-Arnold, E., and Feichtinger, E.—Der Feldversuch in der Praxis. (329 pp.) Wien: Julius Springer, 1929. [37 (01); 37 (43); 37 (072).]

Merchandise Marks Act, 1906.—Report of the Standing Committee set up by the Minister of Agriculture and Fisheries, the Secretary of State for the Home Department, and the Secretary of State for Scotland, on Rose Trees. [Cmd. 3245.] (4 pp.) London: H.M. Stationery Office, 1928, 1d. [343.53; 63.522.]

Board of Agriculture for Scotland.—Miscellaneous Publications No. 7 (1928 Edition). The Residual Values of Feeding Stuffs and Fertilisers. Report by a Joint Committee of Scientific and Professional Men. (13 pp.) Edinburgh, 1928, 6d. [63.1624.]

Board of Agriculture for Scotland.—Miscellaneous Publications No. 8. Seed Testing and Plant Registration Station for Scotland, First Report. (48 pp.+8 pl.) Edinburgh, 1928, 2s. [63.1951.]

Wardle, R. A.—The Problems of Applied Entomology. (587 pp.+4 pl.) Manchester: University Press, 1929, 30s. [63.2; 63.27; 63.295.]

Swanson, C. O.—Wheat Flour and Diet. (203 pp.+9 pl.) New York: Macmillan, 1928, \$2.50. [612.39; 664.6.]

Daglish, E. F.—The Book of Garden Animals. (213 pp.+15 pl.) London: Chapman & Hall, 1928, 7s. 6d. [59.]

Robertson, D. H.—Money. (Cambridge Economic Handbooks) (4th Revised Edition.) (181 pp.) London: Nisbet and Cambridge University Press, 1928, 5s. [332.]

Wright, Sir R. S., and Hobhouse, Rt. Hon. H.—An Outline of Local Government and Local Taxation in England and Wales (excluding London). Sixth Edition by Cecil Oakes. (300 pp.), London: Sweet & Maxwell, 1928, 12s. 6d. [336.28.]

Field Crops

Sutton, M. J.—Permanent and Temporary Pastures, (9th Edition), (202 pp.) London: Simpkin Marshall, 1929, 10s. 6d. [63.196; 63.33; 63.33-16.]

Cox, J. F., and Megee, C. R.—Alfalfa. (101 pp.) New York; John Wiley; London: Chapman & Hall, 1929, 7s. 6d. [63.33.]

Aberystwyth, University College of Wales: Welsh Plant Breeding Station. Series H, No. 9, Seasons 1926-27.—The Effect of Nitrate of Soda on the Yield and Chemical Composition of a Simple Seeds Mixture in the First Harvest Year, by T. W. Fagan, W. E. J. Milton, and A. L. Provan. (27 pp. and Appendix.) Aberystwyth, 1928, 3s. 6d. [63.1951; 63.33.]

Fruitgrowing

Empire Marketing Board. E.M.B. 13.—Grapefruit Culture in the British West Indies and British Honduras. (53 pp.) London: H.M. Stationery Office, 1928, 1s. [63.41.]

Arkansas Agricultural Experiment Station.—Bulletin No. 227. A Study of the Effect of Commercial Fertilizers on the Performance of Apple Trees. (61 pp.) Fayetteville, 1928. [63.41-16; 63.41.]

Michigan Agricultural Experiment Station.—Special Bulletin No. 177. The Significance of Soil Variation in Raspberry Culture. (20 pp.) East Lansing, 1928. [63.41.]

Live Stock and Feeding

Midland Agricultural and Dairy College.—Bulletin No. 18. Report on the Cost Records of Pigs on the College Farm for six years ended March, 1927, by C. W. Roberts and J. Duncan. (23 pp.) Sutton Bonington, 1928. [63.64.]

Minnesota Agricultural Experiment Station.—Bulletin No. 237. Rations for Fattening Baby Beeves and Selection of Calves for Baby Beef Production. (51 pp.) St. Paul, 1927. [63.62; 63.62 : 043.]

Smetham, A., and Dodd, F. R.—The Valuation of Feeding Stuffs by means of Chemical Analysis. (42 pp.) Preston: Royal Lancashire Agricultural Society, 1928, 2s. 6d. [612.394; 63.60433.]

O. M. Holmes.—The Principles and Practice of Horse-Shoeing. (251 pp.) Leeds: Farriers' Journal Publishing Co., 1928. [682.]

Dairying

Associates of L. A. Rogers.—Fundamentals of Dairy Science (543 pp.+1 pl.) (American Chemical Society, Monograph Series.) New York: The Chemical Catalog Company, 1928, \$5.50. [543.2; 576.8 : 7; 63.70; 612 : 664.]

Mattick, A. T. R.—The Production and Distribution of Clean Milk. (76 pp.) London: The Dairyman, 1927, 2s. [614.32; 63.71.]

University of Bristol, Department of Agriculture and Horticulture.—Bulletin No. 3. The Effect of Different Balanced Rations on the Yield and Composition of Milk from Dairy Cows. (18 pp.) Bristol, 1928. [63.711; 63.711 : 043.]

Midland Agricultural and Dairy College.—Bulletin No. 21. Buying Milk on a Quality Basis, by H. T. Cranfield. (4 pp.) Sutton Bonington, 1928. [63.712; 63.716.]

Bibby, J., & Sons.—Bibby's Book on Milk, Section II. The Law Relating to the Sale of Milk: Its History, Criticism of its Administration and Suggestions for its Amendment. (12th Edition, with supplement.) (487 pp.) Liverpool, 1928, 30s. [343.53; 614.32.]

The Co-operative Union.—Agricultural Advisory Service No. 1. Modern Dairy Practice: Notes from the World Dairy Congress, 1928, prepared for the use of Co-operative Societies operating Milk Departments or contemplating such trading, by G. Walworth. (13 pp.) Manchester, 1928, 3d. [63.70.]

The Co-operative Union.—Agricultural Advisory Service No. 2. Modern Farm Practice: Notes from the World Dairy Congress, 1928, prepared for the use of Co-operative Societies interested in Farming, by G. Walworth. (10 pp.) Manchester, 1928, 3d. [63.711 : 043; 63.70.]

Agricultural Economics

Empire Marketing Board. E.M.B. 14.—The Survey Method of Research in Farm Economics, by J. P. Maxton. (38 pp.) London: H.M. Stationery Office, 1929, 6d. [538.1; 37.]

- South-Eastern Agricultural College, Wye.*—Department of Economics. Report No. 6. Corn Growing: Costs of Production and Financial Results, by J. Wyllie. (pp. 121-160) Wye, 1928, 1s. [338.1 (42); 63.31; 63.31:31.]
- Blundell, F. N.*—The Agricultural Problem. (90 pp.) London: Sheed & Ward, 1928, 1s. [338.1 (42).]
- Fielding, Sir C.*—Prosperity for England. (19 pp.) Billingshurst 1928. [338.1 (42); 338.9; 382.]
- Mead, E. S., and Ostrolenk, B.*—Harvey Baum: A Study of the Agricultural Revolution. (149 pp.) Philadelphia: University of Pennsylvania Press; London: Humphrey Milford, Oxford University Press, 1928, 8s. 6d. [338.1 (73).]
- Short, J. B.*—The Butcher's Shop: A Study of a Country Butcher's Business. (32 pp.) Oxford: Clarendon Press, 1928, 1s. 6d. [63.75.]
- New Zealand.*—Report of Royal Commission on Rural Credits, (84 pp.) Wellington, 1928, 2s. 6d. [332.71; 332.71 (931).]

Marketing

- Ministry of Agriculture and Fisheries.*—Economic Series No. 19. Markets and Fairs in England and Wales: Part III.—Northern Markets. (179 pp.+27 pl.) London: H.M. Stationery Office, 1928, 6d. [381.1.]
- Ministry of Agriculture and Fisheries.*—Economic Series No. 21. Report on the Preparation of Fruit for Market: Part I.—Apples, Pears, Plums and Strawberries. (88 pp.+31 pl.) London: H.M. Stationery Office, 1928, 6d. [63.41:38.]
- Saskatchewan Department of Agriculture.*—Report of the Saskatchewan Overseas Live Stock Marketing Commission, 1927. (425 pp.) Regina, 1928, \$1.00. [63 (4); 63.6:38; 63.6.]

Co-operation

- Cork, University College.*—Agricultural Bulletin No. 3. Co-operative Marketing of Agricultural Products, by M. Murphy. (140 pp.) Cork University Press; London: Longmans Green, 1928, 3s. 6d. [334.6; 381.]
- McKay, A. W., and Lane, C. H.*—Practical Co-operative Marketing. (512 pp.) New York: John Wiley; London: Chapman & Hall, 1929, 15s. [334; 334.6; 381.]
- University College of Wales, Aberystwyth.*—Agricultural Economics Department. Marketing and Co-operation: III.—Agricultural Co-operation in North Wales: A Study in Experience, by J. Morgan Jones and R. Harding Wynne. (82 pp.) Aberystwyth, 1928, 1s. [334 (429).]
- Digby, Margaret.*—Producers and Consumers: A Study in Co-operative Relations. Edited by the Horace Plunkett Foundation. (203 pp.) London: Routledge, 1928, 5s. [334; 334.6.]
- The Co-operative Union.*—The Economic Advance of British Co-operation, 1913-1926. By H. J. Twigg. (96 pp.) Manchester, 1928, 2s. [334 (42); 338 (42).]

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MAY, 1929.

NOTES FOR THE MONTH

A DESCRIPTIVE pamphlet, outlining the general programme for the World's Poultry Congress to be held at the Crystal Palace, from July 22 to 30, 1930, has been issued by the Ministry. From a perusal of this pamphlet, it is evident that the Congress is likely to be the biggest event that has yet occurred in the development of the British poultry industry. If the Canadian Congress at Ottawa, in 1927, were organized on similar lines to this, it is not difficult to understand why it attracted 3,000 delegates and 200,000 members of the public. The Ministry's brochure should be in the hands of every member of the poultry industry, for it is obvious that the Congress and its accompanying Exhibition will afford opportunities for increased knowledge and for trade expansion which rarely come the way of the home poultryman or poultry appliance manufacturer.

As shown by the plans of the Crystal Palace incorporated in the brochure, the Congress authorities have allocated the space available as follows :—

- (a) The ground floor will be devoted to a display of high-class live stock (poultry, ducks, geese, etc.) sent in by breeders from all parts of the world. This live stock exhibition will include rabbits and pigeons, but these entries will be shown in the galleries of the main floor.
- (b) The main floor of the Crystal Palace will be devoted to two distinct sections of the Exhibition. In the North Nave will be staged national exhibits displayed by the numerous countries participating in the Congress, illustrating the progress and development of the poultry industry. The South Nave will be set aside for a trade exhibition. It will be open to commercial interests both from this country and abroad. In the Centre Transept, immediately opposite the Grand Organ, the Empire Marketing Board will arrange a spectacular display of poultry-keeping throughout the Empire.

The charges for entries are as follows :—

Poultry (*i.e.*, fowls, ducks, guinea fowl and bantams), £3 per pen of three.

Geese and turkeys, £2 per pen of one or £3 per pair (male and female, separately penned).

Pigeons, £1 10s. 0d. per pair (male and female, separately penned).

Rabbits, £1 10s. 0d. per entry.

Commercial exhibits will be charged at rates varying from 2s. 6d. to 5s. per square foot, according to the site, excluding cost of erection of stands.

In addition to the Exhibition, a programme of conferences confined to delegates is being arranged, which will embrace all important subjects concerned with poultry and other forms of small live stock husbandry. This programme embraces five sessions, and papers will be read by eminent international authorities during each morning of the Congress. The membership fee for delegates from Great Britain and Northern Ireland, including admission to the Congress and Exhibition, is £2 2s. 0d. for full participation, including the receipt of the printed report of proceedings. Delegates who participate in only a partial programme of entertainment and do not desire the printed report of proceedings will be admitted for a membership fee of £1 1s. 0d. In addition, associate-membership is available for those who are unable to attend the Congress but desire to be associated with it and to receive copies of the printed report of proceedings, the fee in this case being also £1 1s. 0d.

A programme of afternoon tours during the Congress is being arranged. Immediately after the Congress is over, delegates may, if they desire, proceed on a conducted tour of Great Britain and Northern Ireland. By invitation of the Irish Free State Government, a short tour in that country will be arranged to coincide with the termination of the main Congress tour at Belfast on August 10.

The Congress enjoys the distinguished Patronage of His Majesty the King, Her Majesty the Queen, and His Royal Highness the Prince of Wales. The Minister of Agriculture and Fisheries, the Secretary of State for Scotland, and the Minister of Agriculture for Northern Ireland are Presidents. Mr. F. C. Elford, of Canada, who is President of the World's Poultry Science Association (the international body under whose auspices successive congresses are run), is First Vice-President. Other Vice-Presidents are the President of the National Poultry Council, the President of the National Farmers' Union, Dr. Edward Brown, F.L.S., and the Right Hon. Lord Dewar, J.P., D.L. Sir Charles Howell Thomas, Permanent Secretary of the Ministry, is Chairman of the General Committee, and Mr. H. E. Dale, C.B., Vice-Chairman of the General Committee. Mr. Percy A. Francis, O.B.E., the Ministry's Poultry Commissioner, has been appointed Director of the Congress. The Secretary of the Congress is

Mr. V. E. Wilkins, Ph.D., B.Sc., and the Assistant Secretary Mr. J. A. McGilvray, both of the Ministry. Copies of the Preliminary Announcement, and all other information concerning the Congress, may be obtained free on application to the Secretary, World's Poultry Congress, 10 Whitehall Place, S.W. 1.

* * * * *

IN connexion with the publication of the World's Poultry Congress Programme, the Minister has addressed the following letter to papers and organizations connected with the poultry industry :—

**The Minister's
Letter to the
Poultry Industry**

DEAR SIR,—As one of the Presidents of the fourth World's Poultry Congress, to be held at the Crystal Palace in July of next year, I would like to draw the special attention of the poultry industry to the brochure published by the Ministry of Agriculture and Fisheries this week, in which the plans for holding the Congress are set forth.

The Congress will be held under the distinguished patronage of His Majesty the King, Her Majesty the Queen, and His Royal Highness the Prince of Wales. Its Presidents are the Minister of Agriculture and Fisheries, the Secretary of State for Scotland, and the Minister of Agriculture for Northern Ireland. The Department organizing the Congress is the Ministry of Agriculture and Fisheries, working in conjunction with the Departments of Agriculture for Scotland and Northern Ireland.

The present time is particularly opportune for the organization in this country of a world's congress devoted to the development of the poultry industry. Egg production has made great strides of recent years, and the fact that it has increased in England and Wales by practically 80 per cent. since 1913 shows the determination of home breeders to secure a greater proportion of the market which lies at their door. The increase in 1928 over 1913 represents a value of no less than £7,000,000—a striking testimony to the efforts which the industry has made, assisted by the educational work which has been done by the Ministry and Local Education Authorities.

The World's Poultry Congress will focus attention on the most successful methods of poultry production and marketing practised in all parts of the world. Britain has pure-bred poultry of unrivalled merit ; the Congress will enable breeders

to bring this stock to the notice of many prospective buyers from overseas. British egg producers have to meet keen competition from imported eggs; the Congress will provide the latest information regarding the most successful methods of production and marketing in all parts of the world, and thus enable home producers to understand better the nature of the competition they have to meet.

The Government are naturally anxious that the British display in all sections of the Congress should be a worthy one. The national educational exhibit, for which the Congress authorities will be responsible, is being prepared with the whole-hearted co-operation of educational and research agencies and of the industry as a whole. In the case of the live stock and trade sections the Government looks to the industry itself to come forward in such a way as to secure for the Congress the very best that the country can offer. The Congress and Exhibition will provide substantial opportunity for trade expansion. Poultry breeders, appliance manufacturers and others will have access not only to those interested in poultry-keeping at home but to a large body of visitors from overseas, and the Congress should do much to assist home breeders to recover the export trade in breeding stock which has unfortunately decreased in recent years.

When the Ministry of Agriculture, at the express request of the National Poultry Council, decided to undertake the arduous task of organizing the Congress, it did so with the assurance that the full support of the industry would be forthcoming. I now appeal to all sections of the industry to show their firm intention of implementing that promise. Many leaders of the industry are already helping in a most practical way by serving on the various committees which have been set up to advise the Department on the general organization of the Congress. It remains for the industry as a whole to follow that lead by becoming Congress delegates, by sending their best stock for display at the Exhibition, and later by personally attending at the Congress and giving it their support. With such co-operation, the Government can look forward with confidence to a Congress which will be a worthy successor to the successful Canadian Congress held at Ottawa in 1927.

Yours faithfully,

(Signed) WALTER GUINNESS,

Minister of Agriculture and Fisheries.

THE Minister has made the two following Regulations under The Agricultural Produce (Grading and Marking) Act, 1928: *On March 11, 1929.*—Agricultural Produce (Grading and Marking) Draft and Provisional (Tomatoes and Cucumbers) Regulations, 1929. *On March 27, 1929.*—Agricultural Produce (Grading and Marking) (Broccoli) Regulations, 1929. (S.R. & O., 1929, No. 201.) These Regulations prescribe grade designations and grade designation marks for tomatoes and cucumbers and for broccoli respectively. The scheme for the marketing of tomatoes and cucumbers under the National Mark will be found on p. 158 of this issue of the JOURNAL.

IMPERIAL Chemical Industries, Ltd., recently arranged to carry out a comprehensive scheme for the improvement of a small holding of 39 acres on the Canwell Estate (belonging to the Birmingham Corporation) by means of a system of complete and balanced manuring. It is estimated that an expenditure of £65 on fertilizers will be required in the first year, and, provided that the tenant is willing to keep simple accounts of his first year's trading, to have a valuation made at the beginning and end of the year, and to apply the manures according to the instructions of the Company's adviser, the Company are prepared to provide £50 towards the £65 to be spent. The Birmingham Agricultural Committee have decided to erect the rough fencing that will be required for the purpose of the scheme, and the result will be awaited with considerable interest.

The Ministry has recently issued a Miscellaneous Publication* entitled "Variations in the Composition of Milk." In the preparation of this publication, the Ministry has had the assistance of a number of experts on the subject of the composition of milk.

The publication gives considerable information, illustrating the wide variations that occur in the composition of milk, both as regards fat and solids-not-fat, and deals with the many circumstances which are known to

* *Miscellaneous Publications*, No. 65, obtainable from the Ministry, 10 Whitehall Place, London, S.W.1, price, post free, 4d. net.

be associated with variations in the composition of milk—such as the “Individuality of the Cows,” “Intervals between Milking,” “Age,” “Breed,” “Period of Lactation,” and “Influence of Food.” The analytical data, taken from various sources, illustrate the variations in milk both as regards fat and solids-not-fat of individual cows and of a herd of cows.

The publication will be of considerable interest both to producers, wholesale and retail milk dealers, and officers of local authorities, who are constantly brought into touch with with this difficult subject.

* * * * *

As indicated in the April issue of the JOURNAL, a second consignment of Cornish broccoli was sent to the Continent on March 12. The Cologne salesman

**National Mark
Export Scheme
for Cornish
Broccoli**

who handled the produce reported favourably on the condition and quality of the consignment and made useful suggestions. The photographic views on the opposite

page show the truck in which the broccoli travelled direct to Cologne and a stack of crates ready for loading.

* * * * *

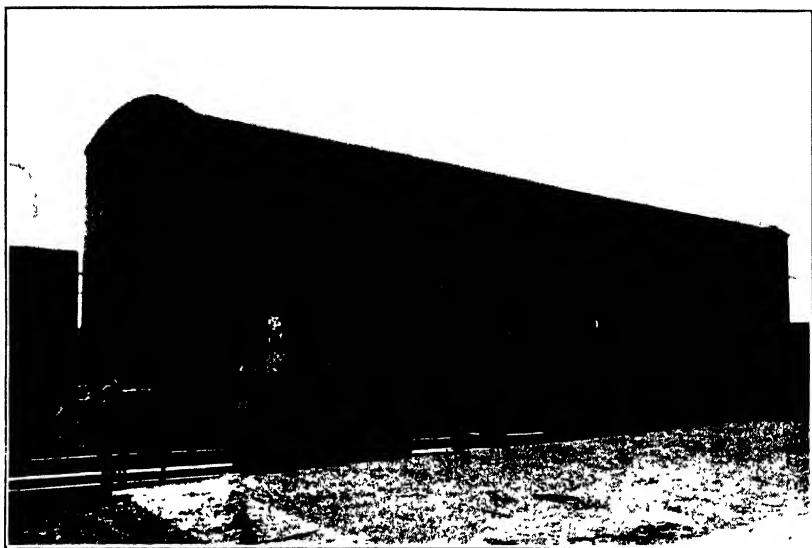
FOR the third year in succession the Ministry, in co-operation with the Beet Sugar Factories Committee of Great Britain, is

**Sugar Beet
Investigations and
Demonstrations,
1929**

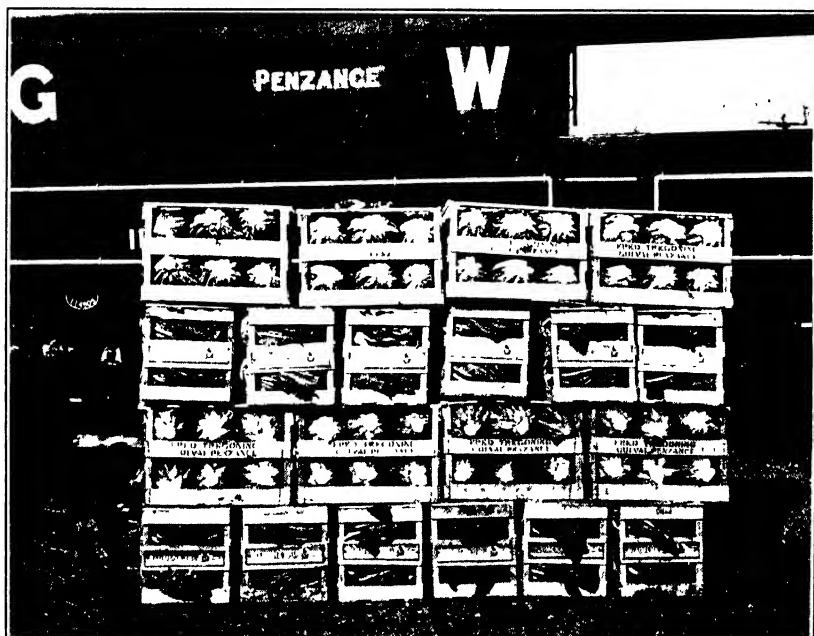
carrying out in various parts of England and Wales, with the assistance of Agricultural Institutes, County Agricultural Organizers and experienced growers, experiments with a view to encouraging a higher standard of cultivation and a

higher yield of beet per acre, the necessary funds having been supplied by the beet sugar factories. The experience of the first two years, which has been carefully codified and examined, has resulted in the division of the scheme this year into two parts, namely, Investigations and Demonstrations.

The Investigations comprise (1) the continuance of the intensive seed variety trials conducted under the ægis of the National Institute of Agricultural Botany, Cambridge; (2) further trials in the use of labour-saving agricultural implements under the guidance of the Institute of Agricultural Engineering, Oxford; (3) a further series of carefully controlled investigations concentrated on certain points connected with the spacing of plants and manuring, on which further information is still required.



The truck in which the broccoli travelled direct to Cologne.



Stack of crated broccoli ready for loading.

THE NATIONAL MARK EXPORT SCHEME FOR CORNISH BROCCOLI.

The last series of experiments is being conducted under the supervision of : Mr. F. Rayns, M.A., Norfolk Agricultural Station, Norwich ; Mr. D. B. Johnstone Wallace, M.Sc., East Anglian Institute of Agriculture, Chelmsford ; Mr. F. Wakerley, M.Sc., F.H.A.S., Agricultural Organizer for Lincolnshire (Kesteven) ; Mr. A. W. Oldershaw, Agricultural Organizer for East Suffolk ; Mr. A. Amos, M.A., University Farm, Cambridge ; Mr. J. C. Leslie, M.A., B.Sc., Agricultural Organizer for Cambridge ; Mr. R. N. Dowling, N.D.A., N.D.D., Agricultural Organizer for Notts ; Professor R. S. Seton, Department of Agriculture, Leeds University ; Mr. J. A. McMillan, Agricultural Organizer for Lines (Lindsey) ; and Mr. E. Druce, Agricultural Organizer for Shropshire.

The Demonstrations are designed to illustrate the fact that the securing of good beet yields requires careful attention on the part of the grower to recognized good principles of cultivation. Under the scheme, approximately 150 growers distributed throughout England and Wales will be asked to act as demonstrators and to conform in broad outline to rules of cultivation, etc., laid down by the Beet Sugar Factories Committee in consultation with the Ministry. Flat-rate grants on an acreage basis will be paid to the demonstrators, and an additional grant in each of the main areas will be paid to the demonstrator who secures the highest sugar yield per acre, taking into account the cleanliness of cultivation and the class of land on which his crop has been grown.

In addition to the above, England and Wales have been divided into 23 areas, including each existing factory's operating area, and any grower under contract (whether a demonstrator or not) of 5 acres or over in a factory area, or of 2 acres or over in one of the Committee's outside areas, can qualify for certain money prizes, to be called "The Beet Sugar Factories Committee Prizes," to be awarded in consultation with the Ministry.

* * * * *

IN the issue of this JOURNAL for October, 1927 (p. 666), some particulars were given of the trials of new varieties of hardy fruits for commercial purposes, which had been undertaken at the gardens of the Royal Horticultural Society, Wisley, Surrey, under the joint auspices of the Society and the Ministry. The object of these trials is to aid the market fruit grower in the selection of new varieties for commercial purposes, and to provide

**Hardy Fruits
for Commercial
Purposes**

growers with reliable information on the characteristics of the newer varieties which will assist them in their selection for planting. Later information has now come to hand in the shape of a progress report for the year ended September 30 last, furnished by Mr. F. J. Chittenden, F.L.S., V.M.H., the Director of the Gardens.

From this, it appears that the area occupied by fruit trees and bushes planted in the trial ground has not been greatly increased in the period under review. A number of young cherry trees have been withdrawn from the trials, pending the preparation of a special site for a cherry orchard, but the ground occupied by them has been replanted with additional plums and apples.

Approximately, $17\frac{1}{2}$ acres are now devoted to fruit under trial. Thirty-seven varieties of different kinds of hardy fruit were recommended and accepted for test in the year referred to, bringing the total number up to 253, made up as follows :—

Apples	..	..	88	Black currants	..	43
Pears	..	..	9	White currants	..	2
Plums	..	..	15	Red currants	..	14
Cherries	..	..	7	Gooseberries	..	14
Damsons	..	..	2	Raspberries	..	36
Nuts..	..	..	1	Strawberries	..	16
			Other berries	..	6	

Several of these varieties are being propagated in the nursery section, and have yet to take their place in the actual trial grounds.

During the year many varieties have been added to the Society's collection of all kinds of hardy fruit and are available for comparison with the varieties being tested.

The trees and bushes and plants established in the trial ground have all made entirely satisfactory progress. Many have reached bearing age, and interesting comparative records are being collected. Late spring frost in March and April, 1928, damaged the currant blossoms and reduced the crop, but sufficient fruit was available to warrant the judging committee inspecting them in summer. Gooseberries, red currants and raspberries cropped heavily; the blackberries under trial also behaved well.

Apples "Superb" and "Herring's Pippin" cropped well, and a judging committee will inspect the last-named in the coming season, with the object of distributing it to the sub-stations for further test. "Superb" is already established at the appropriate sub-stations. The apple "Premier" has cropped well, but, so far, the quality and appearance of the

fruit are not of sufficiently high standard to warrant it being further tested at the sub-stations. The possible commercial value of this apple will be considered by the committee this year.

The judging committee inspected the fruits during the year, and selected for distribution to the sub-stations the varieties :—

Raspberries :	Rival (Laxton)
	Reward (Laxton)
	Epicure (Harraway)
Black currant :	Climax (Macoun, Ontario)

Other varieties were noted by the judges as of promising commercial value, and will be seen again in the coming cropping season.

The total of varieties recommended for distribution to the sub-stations is as follows :—

Black currants	..	..	..	..	17
Red currants	..	..	..	..	5
Gooseberries	..	..	..	..	5
Raspberries..	..	..	..	..	12
Apples	..	..	..	..	2

Ten Canadian varieties of apples have also been distributed for preliminary trial.

Since the commencement of the trials, trees and bushes to the total of 6,720 have been distributed from the central station to sub-stations for further testing. These sub-stations were visited during the summer and reports have been received upon the cropping and general behaviour of bushes and trees in each. In every case progress is satisfactory. A sub-station at High Houghall (Durham) is now established, and 600 bushes and plants have been supplied from the central station and planted there during the year under review.

Demonstration plots have been established at East Malling (Kent) and Cambridge. The full complement of 10 sub-stations is now in being, and all are planted with material recommended by the judging committee.

The special black currant "crop weight trial" plots have been planted at East Malling, Long Ashton and the Central station; they were visited during the summer, and good progress has been made at each station.

Special attention was given to the comparison of the strawberries "Royal Sovereign" and "King George V" (Laxton) with the object of defining any difference that may exist between them. It was found, however, that greater differences existed between stocks of "Royal Sovereign" from different

stations than between stocks of "Royal Sovereign" and "King George V" from the raiser. The judging committee were not satisfied that the two are not for all practical purposes identical.

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A COMPREHENSIVE article upon the National Mark Egg Scheme appeared in the March, 1929, issue of the JOURNAL.

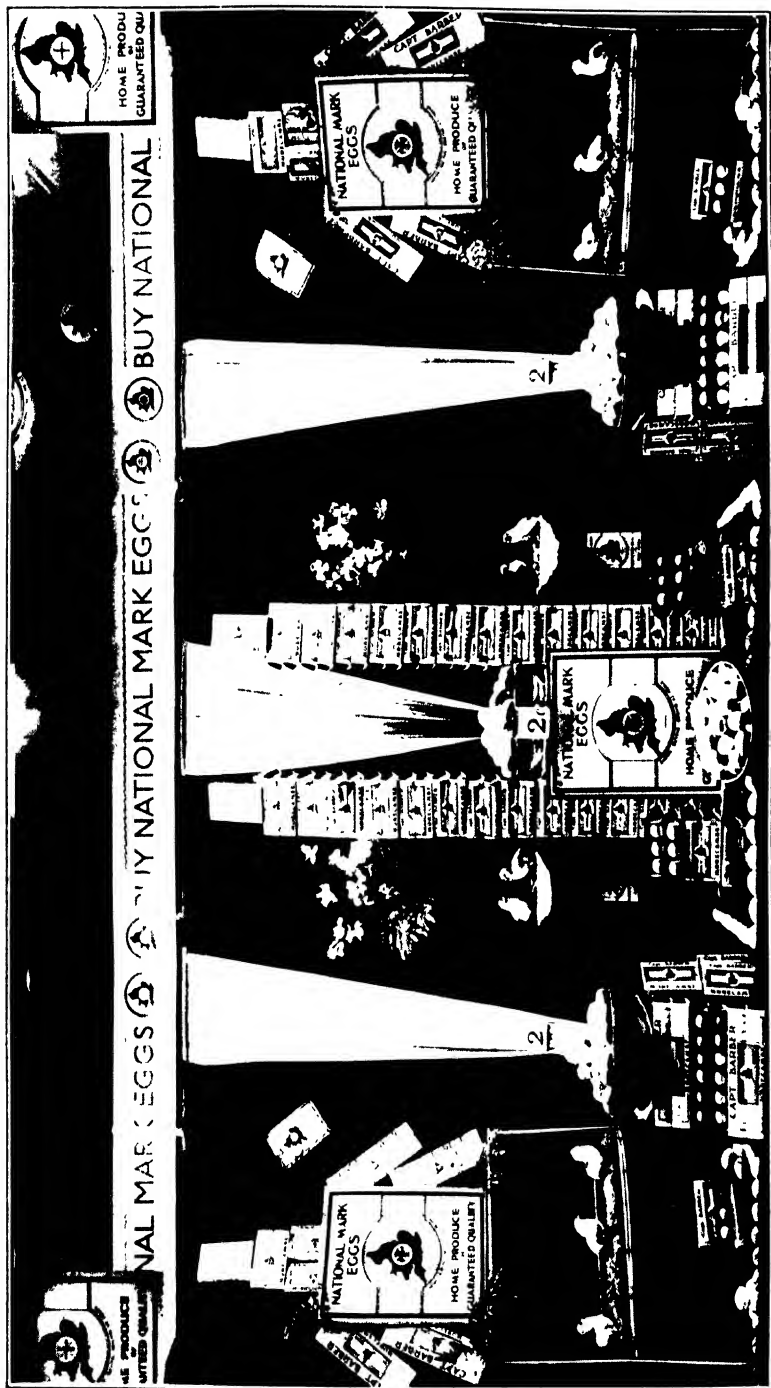
Since that date, the Scheme has developed rapidly and can now be said to be firmly established. The number of egg packers applying for registration has reached a total of just over 200 and, of these, about 150 have so far been authorized to apply the Mark. With the season of maximum production, there has been a notable increase in the quantity of National Mark supplies marketed. Since the inception of the Scheme 480,000 box labels and 764,000 carton labels have been issued to registered packers.

Much publicity has been given to the Scheme both in the Press and elsewhere, and this has no doubt helped to stimulate the public demand, which has continued to exceed the supply. A further stimulus to the Scheme should result from the meeting of the General Purposes Committee of the Federation of Grocers' Associations of the United Kingdom, which was held in Bristol in March, when the following resolution was passed :—

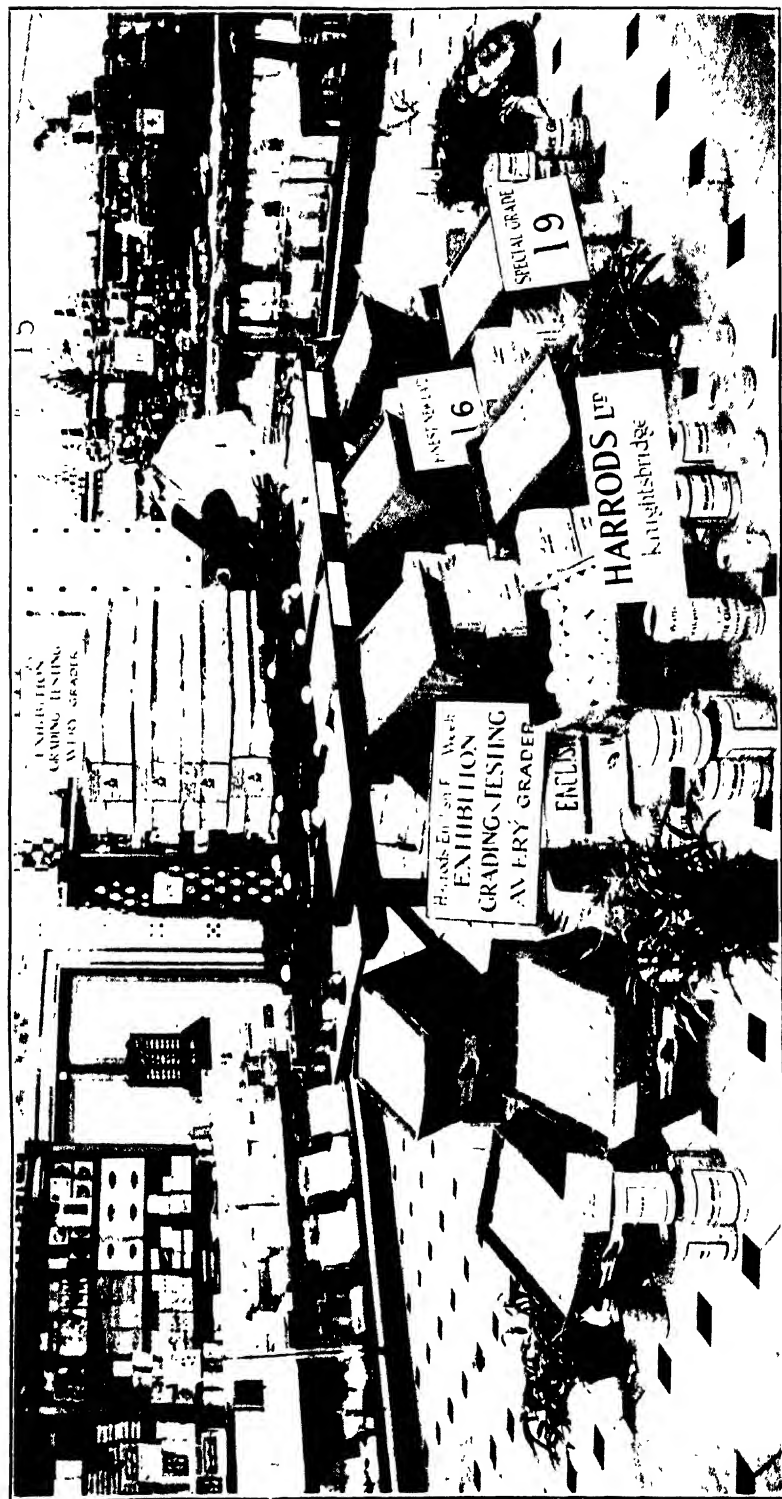
"The quarterly meeting of the General Purposes Committee of the Federation of Grocers' Associations of the United Kingdom, representing over 40,000 retail establishments, realizing the economic importance of the National Mark Egg Scheme to home agriculture and its value to national well-being, pledges its wholehearted support to the scheme and undertakes to do all in its power to ensure its complete and lasting success."

In some cases, enterprising packers have successfully co-operated with retailers, or have arranged demonstrations on their own premises, to further the sale of National Mark supplies. The accompanying photographic views, for example, show, respectively, a window display at the Bradford Co-operative Stores during a recent local egg week, and a special exhibition at Harrods Stores, London.

The passing of April, 1929, has seen the completion of the measures planned to operate co-ordinately with the National Mark Scheme. The marking of preserved eggs took effect from March 1 and, since April 21, the marking of imported eggs has been enforced. From the same date also, British cold stored and chemically stored eggs are required to bear



Window Display of National Mark Eggs by the Bradford Co-operative Stores.



Exhibition of Egg Grading and National Mark Eggs at Harrods Stores, London.

their respective identification marks. Now that preserved, cold stored, and imported eggs will no longer be able to masquerade as British New Laid and the housewife will know what she is buying, the real testing time for the home-produced egg has arrived. Quality, reliability and efficient marketing will win in the end, and it therefore behoves everyone interested in the home industry to co-operate in the efforts now being made through the National Mark Scheme to establish once and for all the commercial supremacy of the home egg in the home market.

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THE Agricultural Committee of the Salop County Council evolved in 1927 a scheme for Junior Agricultural Organized Courses. The primary intention was to provide instruction for boys and girls aged 14 to 16, but the latter age was not strictly made the upper limit, and older students were admitted. The object of the courses was to create or develop interest

**Junior
Agricultural
Courses
in Salop**

in rural life by giving the students an insight into the processes of nature which underlie all growth, and into the general management of the farm. It was hoped that the outcome of such training would be a desire to go into rural pursuits, and the advancement of the students into better and more intelligent rural workers. The classes were to be held during 20 weeks from October to March, and to occupy two hours on two evenings a week.

The bulk of the subjects considered as suitable for such classes were to be taken by both boys and girls and would occupy rather more than two-thirds of the course, while the balance of the boys' time would be allotted to woodwork, elementary farriery and the care of implements, and that of the girls to cookery and domestic science. The studies which were to be shared by both embraced English, rural lore, elementary agriculture and horticulture, poultry management, and agricultural mathematics. Such a programme depends in part for its success on the staff at the disposal of the Agricultural Organizer, but it is equally dependent on the assistance that he can look for from the schoolmaster where the course is held and from other educationists and educational centres. In addition, the cookery classes must be staffed.

When the first course was begun in Shropshire, the subjects which fell to the agricultural education staff were rural lore,

agriculture, horticulture, poultry management, elementary farriery and the care of implements. At the first centre the schoolmaster made himself responsible for agricultural mathematics, English and woodwork, and assistance was to be sought from the Shrewsbury Technical College for some account of internal combustion engines, and from the Shropshire Technical School for Girls at Radbrook in relation to domestic science.

The aim throughout was "rural bias." The work in agricultural mathematics sought its examples on the farm or in the farmyard, and the woodwork was of the sort which the farm and small holding present. It was intended, for example, to give special attention to the making of poultry appliances. Rural lore was intended to embrace simple agricultural history and the growth of implements, and to arouse interest in things past and present, and so encourage and develop a love of country life and all appertaining to it. It finds many of its lessons and examples in surviving customs and place names, and, like agriculture and horticulture, draws the student's attention to the consideration of those everyday objects he is so often unaware he has observed. Up to a point, elementary horticulture served a double purpose, as it covered the formation, composition, and properties of soils and their main types, and the growth of plants. Then elementary agriculture took up the story with drainage, crops and manures. Both, however, owed something to rural lore, with its tale of more primitive days, of earlier struggles with nature, times of simpler cropping, and the rise of an elementary rotation. The agricultural lessons led on to the care of stock. Book-keeping was included in the course. The Salop County Council employs a Farriery Instructor, and it fell to him to deal with the proper care of farm implements and machinery. He also discussed the structure of the horse's foot and the principles of horse-shoeing. Being an expert in oxy-acetylene work he was able to show his classes something of repairs for farm equipment in general.

The first course opened early in October, 1927, at Pontesbury, some eight miles south-west of Shrewsbury, with a preliminary meeting where 18 boys and 15 girls were enrolled. Arrangements had been made for most of the classes to be held in the Pontesbury schoolroom, the woodwork to be taught in an adjoining hut, and the cookery lessons given at the Deanery Hall. The Farriery Instructor had the use of

the local smithy for such of his processes as were best conducted there. A course of this type sustains its interest better when aided by diagrams and simple demonstrations, and consideration was given to the supply of the necessary material.

Within a fortnight the attendance register showed 56 names, 35 boys and 21 girls, and it had become necessary to divide the classes in agricultural mathematics, English and woodwork, and to secure the assistance of the Headmaster of Cruckmeole School. It was estimated that about half of the whole class came from farms or small holdings, and that the rest were labourers' children. About half of the pupils fell into the 14 to 16 years old group, and a number of them came from a distance, either by bicycle or by motor bus or train. It may be said with some certainty that the balance of the youths, those of 17 years of age and over, had definitely chosen an agricultural career.

Towards the end of the course an original note was struck in concluding the English lessons by asking the class to write an essay on the lines along which they thought the course might be improved if held at some other centre during the next winter. It has to be admitted that some of these essays revealed in their suggestions that the writers had their eyes on careers other than rural. There was expressed a desire for practical tasks in chemistry and biology, that is laboratory work, a recommendation not easily adopted in the average country school. Woodwork had satisfied their taste for doing things, and was clearly a popular subject. It is of particular interest to record that practically all the essay-writers considered that a fee should be charged for the course, some making it in effect "caution money," returnable under conditions of attendance and behaviour. Homework was suggested, and an examination at the close of the course, on which the issue of certificates would depend. Such views can leave no doubt as to the keenness of the writers.

The experience at Pontesbury warranted the Agricultural Education Committee deciding to repeat the course at two other centres, Shifnal and Hodnet, during the past winter, 1928-29. Not only so, the Committee also carried the original course into a second year, consisting of 50 hours' instruction. The first meeting at Shifnal brought an attendance of 39 pupils, and as an example of how local help may be enlisted, it is worth adding that at this centre agricultural mathematics was taught by the local Secretary of the National Farmers' Union. At Hodnet the registers contained 60

names before October had run its course, rather over half of the pupils being between the ages of 14 and 16. The advanced course at Pontesbury embraces English, elementary agriculture and elementary horticulture, poultry-keeping, with elementary engineering and woodwork for the boys and cookery for the girls.

The results of these pioneer classes in Salop show that there is a very definite demand for instruction with an agricultural bias amongst boys and girls who have recently left school. The attendance dropped considerably towards the end of the courses, but those remaining were the keenest pupils and were then better able to get individual attention from the teachers. There is no doubt that the large numbers joining the course, owing to the wide publicity given to the proposed instruction, rendered it difficult to handle them properly, and the falling off in numbers as the course proceeded rendered the teachers' task easier.

While it is yet early to judge, these courses should prove a valuable aid in feeding the Ministry's Scholarships for the sons and daughters of farm workers, and should be a stepping stone to a course at a Farm Institute or an Agricultural College.

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THE following information about the Wiltshire Agricultural Accounting Society has been communicated by Mr. W. T.

**Wiltshire
Farmers'
Accounting
Society**

Price, the Agricultural Organizer for Wilts. The Society was founded in August, 1925, with the object of assisting farmers to discuss together their financial problems which, as everyone knows, have become very acute during recent years. It has the unanimous support of the County Executive of the National Farmers' Union and is under the able chairmanship of Mr. Richard Stratton.

The members of the Society, who must be actually farming in Wiltshire, keep simple accounts of their disbursements and receipts during the year, together with a record of their farm valuations at the beginning and end of each year. The information required is that which is often submitted to the Income Tax authorities or required by a professional accountant. In fact, in many instances the professional accountant is of very great assistance both to the individual member and to the Society, for he often puts the accounts in a form in which they are more easily analysed for the purposes described below and, it may be emphasized at once,

in order to avoid misunderstandings, that the Society does not wish to supplant professional accountants. Its Officer only prepares accounts for farmers in cases where previously none has been kept and where the farmer specially desires him to do so. On the other hand, the Society is only too glad to receive the assistance of accountants and to co-operate with them in any way.

It has often been said that accounts in themselves teach nothing, and that only when accounts are intelligently interpreted are they really worth while. This interpretation of the accounts is the most important aspect of the work of the Wiltshire Agricultural Accounting Society, and, indeed, was the fundamental reason for its formation. Briefly, the methods adopted are as follows :—

The accounts, when completed by the farmer or accountant, are sent to the Accounting Officer of the Society, who works in close touch with the Economics Section of the Agricultural Department of the University of Bristol. The Society's Officer, upon receipt of the accounts, dissects and analyses them. The results are then tabulated for each farm and are sent, with a brief report, to the individual farmer concerned. By means of such reports the attention of the farmer is called to any class of income or expenditure that appears to be abnormal. For instance, the relation between output and expenditure incurred in its production is examined, differentiation being made between prime and secondary costs. The proportions of total prime, or production, costs absorbed by such items as wages, manures and foodstuffs, are also considered, with the object of ascertaining whether a better balance between these items might not be possible. The individual farmer is, of course, the person who decides whether the suggestions or recommendations made to him are worth acting upon. No two farms are alike, yet it is often possible for the onlooker, "who sees more of the game," to indicate where improvements may be made. Thus, a farmer may feel quite satisfied either with his annual profit, or with his output from the farm, until he finds that other similar farms are doing considerably better. This is one of the ways in which the Society helps the individual. Each member's farm is given a distinguishing number, which is known as a Code number. No person, other than that farmer, the Advisory Economist at Bristol University, and the Society's Accounting Officer, can relate any code number to the name and address of the farmer. By this means the

confidential and private nature of each farmer's business is strictly maintained. Whenever reference is made to the accounts by the members of the Society, the code number only is used. At the conclusion of each financial year the results of all the members are tabulated and a copy sent to each, so that by looking for his code number in these tables a farmer is able to find how he compares with the other members. He may find, for example, that last year his position in order of financial success was nineteenth out of fifty, whereas this year he is twenty-fourth. He does not know the *names* of those who have beaten him, but he knows that his position is relatively worse than in the previous year, and he begins to look around and "to pull himself together" in a determination to beat Code number "So-and-so" next time. In this connexion it should also be pointed out that the accounts, when analysed, are of particular use to the farmer when he calls in the Agricultural Organizer or his staff for the purpose of advising him on technical matters in connexion with his farm.

But the work of the Society does not end with the compilation of tables of results, useful as these are. Every year the members meet at two or three centres in Wiltshire, not only to discuss the tables giving their results, but to consider general problems of farm management, to interchange ideas and to consider the position of agriculture in Wiltshire in relation to that in other counties.

Membership is not confined to any class or section of the agricultural community. Any farmer, owner or tenant, large or small, may join the Society, the only qualifications being that his farm must be in Wiltshire and that he will agree to pay a nominal annual subscription according to the following scale :—

	<i>Per farm</i>
Farms not exceeding 250 acres	2/6
Farms exceeding 250 and not exceeding 500 acres . .	5/-
Farms exceeding 500 and not exceeding 1,000 acres . .	7/6
Farms exceeding 1,000 acres	10/-

Any Wiltshire farmer who may be interested in the work of this Society should write for full information and an *Application Form to the Society's Accounting Officer*, Mr. M. C. Thorne, 15 Friar Street, Reading; to Mr. W. T. Price (Agricultural Organizer), Secretary, Polebarn House, Trowbridge, or to Mr. C. V. Dawe, Advisory Economist, 22 Berkeley Square, Bristol.

COMMON SALT ON THE FARM

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EARLY last century, cases were reported in this country in which salt appeared to be highly valuable as a manure. Sinclair, for example, writing in 1817, affirmed that whereas a dressing of farmyard manure gave a 40-50 bushel crop of wheat in a particular instance, the yield was increased to 70 bushels by a light dressing of common salt and to 90 bushels by a heavy dressing. By the middle of the century, salt was used regularly for mangolds and for stock in some districts, evidence of this being found in some of the prize essays appearing in the *Journal of the Royal Agricultural Society* about this time. In the 'forties, a Commission was sent over from France to inquire into and report upon the effect of salt as a manure. Lawes, who had written to the editor of an agricultural journal in Paris to ascertain the findings of this commission, was told that it had been concluded that salt was useless as a manure; the writer, however, hinted that this conclusion might not be reliable since the person responsible for drawing up the report was strongly in favour of a salt tax and was anxious to show that such a tax would not harm agriculture. Lawes accordingly carried out an investigation of the value of salt as a manure.¹

Salt for Wheat, Oats and Barley.—Many of the earlier instances of increase of crop due to salt cannot be relied upon owing to the crude methods of carrying out the experiments. Even in the trials which were carried out with more care, the differences in crop then attributed to the salt would not be regarded to-day as being of sufficient magnitude to be significant. Voelcker, for instance,² writing on experiments with different top dressings for wheat, reports an increase of 2 bushels per acre due to salt; again, experiments carried out on the estate of the Earl of Leicester in 1852-54 resulted in the "no salt" plots giving, for the three years, $8\frac{1}{2}$ bushels more wheat and 6 cwt. more straw than the plots which had received salt—differences not large enough to be significant.

Lawes' trials were of a more exact nature. On land carefully chosen for the experiment, the "salt" and "no salt" plots were tested for soil differences by weighing the crops for three years before the salt was applied. In addition, at the end of salt and no salt comparisons, which were carried

on for three years, the crop was observed and weighed for a further period of 10 years in order to detect any possible after-effect of the salt. The plots were cropped continuously with wheat during the 16 years, and salt was the only dressing applied. The grain and straw were weighed, and the proportion of offal determined in both cases. Lawes concluded—"taking the 16 years, the results are almost identical; that is to say, we see no effect whatever from the use of salt in these careful and prolonged experiments."

Experiments carried out by the Norfolk Chamber of Agriculture³ in 1889 and 1890 on barley showed no increase in yield resulting from salt. It was observed that the salt had a distinctly weakening effect on the straw—an interesting observation in view of the belief prevalent in some quarters that salt was useful in strengthening the straw of cereals.

Pot experiments carried out at Woburn in 1900 resulted in a decreased yield of grain as a result of applying small dressings of salt. There are few instances where salt proved useful as a manure for cereals. At one centre⁴ (Garforth, Yorkshire), an average annual increase per acre in the barley crop of 5 bushels of grain and 5 cwt. of straw was obtained over five years. These trials were carried out to test whether salt counteracts the tendency of the crop to lodge when following roots. No evidence of this was found. In the same county, it is a practice in some areas to mix salt with nitrate of soda as a top dressing for wheat, and mangolds but no evidence is available as to its effect on the yield of wheat.

Reference to the effect of chlorides (in muriate of ammonia) on grain production in barley is contained in a paper by the Director on the Rothamsted field experiments,⁵ 1925-26. In comparing muriate (or chloride) of ammonia with sulphate of ammonia, it is observed that the chloride in the former "seems to increase the number of grains attaining the size of head corn"; this is brought about without any corresponding increase in leaf and straw. Again, in each of the five years 1922-26, the grains from the chloride plots had a slightly lower nitrogen content than those from the sulphate plots, so that a better malting sample was given by the former on the assumption that low nitrogen content is desirable. It does not follow that common salt would have similar effects to these, but it is possible that the earlier experiments with salt were not carried out in such a manner as to enable these small differences to be detected.

Heavy dressings of salt are harmful to cereals. The Woburn Pot Culture experiments have shown that while small dressings may be beneficial, heavy dressings decreased the crop, and two tons per acre destroyed the crop.

Mangolds.—Salt is often included in manurial dressings for this crop. A liberal supply of potash is essential for a heavy mangold crop, and the beneficial action of salt is probably due to its power of increasing the supply of available potash in the soil. It was formerly believed that mangolds benefited from a dressing of salt because the wild species of this plant is a marine plant and thus accustomed to high concentrations of salt. The Rothamsted experiments on the continuous growth of mangolds show unmistakably that the sodium in nitrate of soda increases the yield, and it is probable that the sodium in common salt has a similar effect. Salt was used extensively for this crop in the middle of last century, and the *Journal of the Royal Agricultural Society* from 1864–70 contains reports of much experimental work on the soundness of the practice. The earlier trials resulted in conflicting results; Voelcker obtained increases of $5\frac{1}{2}$ tons per acre in some cases, and no increase in others. Lawes, who used salt regularly for the mangold crop, laid down a trial in 1864 and obtained a lower yield as a result of salt; he observed that plants receiving no salt grew faster than those which had been manured with salt. Trials carried out at Woburn from 1905–07 resulted in the conclusion that “salt can be used advantageously up to 6 cwt. per acre.”

A trial was carried out in 1925, in triplicate, at the College Farm of the University College of North Wales, Bangor, to determine the effect of salt on the yield of mangolds when applied with kainit and without kainit, and whether a dressing of 10 cwt. was superior to one of 5 cwt. per acre. In this trial, the salt increased the yield by an average of over 6 tons per acre, or nearly 23 per cent. when used without kainit. When used with 5 cwt. of kainit per acre, however, there was practically no increase in yield. Thus, whilst salt was capable of giving large increases in the yield, it proved to have no effect when the crop received kainit. In an adjoining trial, kainit proved far superior to sulphate of potash as a manure for mangolds, and this must have been due to the presence of salt or similar substances in the former. The Bangor trial confirms the conclusion stated in this

Journal in 1903,* when salt was declared to be unnecessary if kainit was used.

The effect of salt on the dry matter content of mangolds has not been tried. The Rothamsted experiments with muriate of ammonia indicate that the chloride may increase the dry matter, and, if this is so, it is possible that a similar effect would result from the use of salt.

Other Root Crops.—Salt and other chlorides are believed to have a harmful effect on the quality of potatoes. Voelcker carried out several trials of the effect of salt on the yield of potatoes and swedes, but found no evidence of a beneficial effect. Salt is often recommended and used for cabbages.

Grassland.—Salt is sometimes recommended for grassland, either for helping to eradicate certain weeds, controlling certain parasites affecting farm animals, or for inducing animals to graze rough, foggy pastures more closely and thus improve the quality of the herbage. Brenchley advocates† the use of salt as a means of reducing weeds, especially on grassland; an application of 5 to 6 cwt. per acre in spring when Nettles are cut down helps to eradicate them. Also, a dressing in April will help to keep down the Ox-eyed Daisy. Yellow Rattle is also destroyed by salt.

After the Liver Rot epidemic of 1879–80, a dressing of salt was recommended in many quarters as a means of controlling the disease by destroying the snails which act as intermediate hosts. It was pointed out by Wright, however, that if salt were applied at a sufficient rate to destroy the snails, it would also burn the pasture. In any case, it is now known that copper sulphate provides a much cheaper and efficient method of destroying the snails responsible for this disease, and salt can be ignored for the purpose.

Many trials were carried out in the 'sixties of last century to test the effect of salt on the yield of grass; Voelcker summarized these and concluded that "dressing with common salt diminished the weight of grass crop."

Salt was believed by many prominent graziers to improve the quality of grassland by inducing stock to eat down rough grass. Evershed⁶ reports (on hearsay) a case of a poor, sour, grass-fogged hillside on which the rotting uneaten summer

* *Journal of the Board of Agriculture*, March, 1903, p. 437.

† *Journal of the Ministry of Agriculture*, March, 1919, p. 1481.

growth destroyed the pasture in winter. A dressing of 10 cwt. of salt per acre is said to have so improved this that "the cattle pastured themselves on it, and the land has pastured well ever since." In the 1895-1904⁷ pasture trials of the Royal Agricultural Society, salt was tried at two centres where the grass was very foggy and contained much bent grass. No improvement was seen. As a result of five years' experimental work at eighteen centres under the Agricultural Department at Reading,⁸ the conclusion was reached that "there is no evidence to show that salt makes pastures fine as is popularly supposed." This conclusion needs no modification in the light of later work.

Effect on Soil Texture.—Flooding by sea water causes severe damage to land, especially to arable land. The effect of the flooding of heavy land in 1921 on the banks of the Humber was investigated by Page and Williams.⁹ Much of the land was under sea water for periods varying from 2-14 days, and while grassland made a complete recovery in three years, the arable land was still derelict in four years. The harmful effect was not due to the amount of sodium chloride remaining in the soil, since in 1924, when the land was still derelict, only 0.05 per cent. was present—an amount which is harmless to crops. The damage was attributed to the effect on the tilth, the soil being impervious when wet, and becoming leathery when drying commenced; when dry the soil was cement-like in hardness. Gedroiz found that soil which had an original clay content of 39.9 per cent. had, after treating with sodium chloride and washing, an apparent clay content of 59.8 per cent. Also, by treating a sample of soil with sodium chloride,¹⁰ and repeating the treatment, a "sodium clay" was finally obtained which was of a most marked hydrophilic character, gelatinous, bulky, and showed little tendency to flocculate. The harmful effect of sea water, which contains approximately 2.7 per cent. sodium chloride, is due to the effect of the chloride on the soil texture. It is probable that heavy dressings of salt have a similar harmful effect on soil texture.

For Farm Animals.—A certain amount of salt is necessary for the health of all animals, it being an essential constituent of saliva, gastric and other juices, and also the source of free hydrochloric acid in the gastric juice. It also helps digestion by assisting in the passage of certain substances through the

walls of the stomach and intestines, and it is also necessary for dissolving the proteins. Salt is also a necessary constituent of blood, lymph, etc. A cow provided with an insufficient amount of salt over a long period has been described¹¹ as developing a strong craving for it, gradually losing vitality, becoming rough-haired, thin in the flesh and finally suffering a complete breakdown.

Common salt is contained in varying amounts in all foods commonly fed to farm stock, and the answer to the question whether salt should be added to the ration of farm animals depends mainly on the quantity of this mineral contained in the ration. There is no doubt that the rations of farm animals in many parts of the world are deficient in this mineral and Halnan¹² regards sodium and chlorine as "elements that experience has found to be normally deficient in certain dietaries." Evidence of this is contained in reports of experiments on the necessity of salt carried out in the United States. In an experiment at the Iowa Experimental Station, for instance, 28 flocks of sheep were observed for over 7 years; the average consumption of salt per ewe per day amounted to a little under half an ounce, the ewes averaging 134 lb. live weight. Ewes receiving no added salt made an average daily gain of 0.278 lb., and gave lambs averaging 8.9 lb. at birth. Ewes receiving $\frac{1}{4}$ oz. of salt a day made an average daily gain of 0.318 lb., and gave lambs weighing 10.3 lb. at birth. This addition of salt appeared to be the optimum quantity under the conditions of the trial.

The use of salt appears to be general in many parts of the United States, and is advocated by most of the Research Stations. For instance, in "Minerals for Live Stock"¹³ it is stated that "all farm live stock need a certain amount of common salt in the ration. This view point is so common that it would be difficult to find many farmers who were not using salt for their live stock."

At the Iowa Station trials,¹⁴ the salt consumption was found to vary according to the components of the ration, and the opinion was expressed that salt consumption probably increases as larger amounts of fibre and protein are consumed. Again, in experiments of a fundamental nature on the mineral metabolism of the dairy cow,¹⁵ it was found that the outgoings of sodium and of chlorine from the body may be affected by such conditions as temperature, the amount of water consumed, and the rapidity of passage of food through the alimentary tract. Thus, the salt requirements of animals

depend on the supply in the ration, and also on other factors connected with digestion; in many parts of the United States an addition of salt to the ration of farm stock appears to be necessary for normal production of milk and meat, and for growth.

It is the exception rather than the rule to feed salt in this country, and one is often asked whether the use of salt would increase production of meat and milk. In the mineral metabolism experiment referred to, it was concluded that a cow normally carries considerable excess of sodium and of chlorine in reserve and that this can be drawn upon. Armsby¹⁶ concludes that "the amount (of salt) actually necessary is less than is often supposed." Recent researches¹⁷ on the mineral requirement of cattle indicate a very low requirement for sodium and chlorine. A ration containing a total amount of sodium equivalent to only about one-eighth of an oz. of common salt, and chlorine equivalent to only about one-fifth of an oz. of salt was fed to two heifers for a period of 18 months. Both were in excellent condition at the end of that period and had made growth as good as those receiving a similar ration with a daily allowance of about one oz. of salt. (Neither of the two heifers calved normally; this may have been accidental and no opinion is expressed.) The conclusion arrived at was that the sodium requirement for growth is very low, sodium equivalent to about one-eighth of an ounce and chlorine equivalent to about one-fifth of an ounce of salt in the ration being more than sufficient for the heifers in the trial.

An indirect indication of the low sodium requirement of farm stock is to be found in the recent investigations into the mineral content of pasture grass.¹⁸ Most of the cultivated pastures examined contained a higher proportion of all minerals (expecting one) than the hill pastures. Sodium provided the exception, the poor hill pastures containing more of this element than the cultivated pastures. Again, if it is assumed that the good pastures examined were not lacking in minerals, a total amount of sodium equivalent to only 1½ oz. of common salt is sufficient for an animal consuming about 20 lb. of dry matter per day (the cultivated group containing only about 0.25 per cent. Na_2O). Most rations used in this country supply this quantity.

In this country, where no part is very distant from the sea, it is probable that salt is carried from the sea by the wind to most districts. Sea spray is recorded¹⁹ as having been

carried by a hurricane as far as Kendal from the West Coast, and it is reasonable to suppose that salt would be carried to a much greater distance than the actual sea spray. Goitre in the human race and in cattle is prevalent only in those countries situated at great distances from the sea, and this is believed to be due to the food plants being lower in iodine (which is present in the sea water) than those grown near the coast. It is probable that, in districts situated at great distances from the sea, or at shorter distances with the prevailing wind from the land, the food plants of the animals might be lacking in salt and that consequently this mineral should be added to the ration under such circumstances. For example, in some parts of the Midlands, as on the chalk, both cattle and sheep relish salt intensely, and it is probable that the grassland in such areas is deficient in this mineral. Under most conditions of farming in this country, however, common salt can be neglected in the feeding of animals, excepting, perhaps, for cows yielding abnormal quantities of milk.

Provision of Salt for Stock.—During summer, the salt may be provided in the form of licks placed in the field, or in the byre in the case of milch cows. During winter, the salt may be added to the meal or chaff mixture, or may be distributed by means of the hay stack; this method of salting animals, *i.e.* using salt when stacking the hay, saves time and trouble and improves both good and bad hay.

Other Uses.—Salt is much used in veterinary medicine and surgery. Its use in the curing of bacon on the farm deserves mention in these days of cheap pigs and dear meat. Salt is also helpful when stacking hay after a difficult harvest; a few pounds of salt scattered over each load of hay in the stack not only helps to flavour the hay but minimizes mouldiness.

The Solages²⁰ method of fodder preservation, which is giving encouraging results on the Continent, is based on the use of salt in the stack. The hay crop is left unturned in the swath until three-quarters dry, when it is carted and stacked; common salt at the rate of 1 lb. per 50 lb. of fodder is added when stacking. The presence of salt in this quantity is claimed to prevent excessive heating and mouldiness. The advantage claimed for this method is the elimination of all the processes of haymaking except mowing.

General Conclusions.—The mangold crop is the only ordinary farm crop which, as a rule, benefits from a dressing of common

salt. Experiments have shown that when about 5 cwt. of kainit is given to this crop, an additional dressing of salt is not likely to give a return.

There is no evidence to show that a dressing of salt improves rough, foggy pasture by inducing close grazing.

Large dressings of salt are harmful to soil texture.

Salt is probably not necessary in the feeding of farm live stock under ordinary conditions. The grass and hay crops grown in districts situated at a distance from the sea may be deficient in this mineral, and in such cases this can be remedied by rock salt.

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TAPIOCA MEAL AS FOOD FOR PIGS

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THE pig-feeder is largely dependent upon barley and maize for the starchy foods which necessarily form a large part of the ration of the fattening pig, especially in the later stages of bacon production. Where potatoes or whey are available, some economy can be effected in the use of the starchy meals, but otherwise it is difficult to avoid a liberal use of barley or maize. Under present conditions, this imposes a very serious burden, and any alternative source of cheaper digestible carbohydrates must constitute a real boon to the pig-feeder.

Such a material would appear to be available in the form of Tapioca (Manioc) meal, but, before it can be generally recommended, some evidence as to its suitability and safe dietetic qualities is desirable. Tapioca meal has long been shipped to this country, but until recently it has not been used in any quantity for feeding purposes as a "straight" meal. It was with the object of obtaining the desired evidence that the experiment with which this article deals was designed. It is to be regarded as of a preliminary character only, and awaits confirmation by further tests on a larger scale, but it may here be added that subsequent use of the meal in the ordinary work at the College has entirely confirmed the favourable impression derived from the experiment.

The Nature of Tapioca Meal.—Tapioca, cassava, or manioc is the tuberous product of two species of plant belonging to the natural order *Euphorbiaceæ*, viz. *Manihot utilisima*—bitter cassava, and *Manihot palmata*—sweet cassava. Both plants are native to tropical countries, Brazil, India and the East Indies being three of the countries in which they are found. The bitter cassava contains a poisonous juice which must be expressed before the root can be of use. The residue of the root is then finely ground and sifted to give various grades of meal. Of these there would appear to be four :—

- (1) Ground roots.
- (2) "C" tapioca, which is, apparently, partially screened meal.
- (3) "B" tapioca, made from the roots with the rind or bark removed.
- (4) "Ground Ampas," which is the ground up rind or bark,

Of these grades No. 3, "B" Tapioca, is undoubtedly the best, and is understood to be well known to the feeding-stuffs trade. This is the material which was used in the trial here recorded.

Owing to the varied nomenclature used in the description of tapioca products it is difficult to find reliable analyses for them. Smetham and Dodd (*Roy. Lancs Agric. Society's Journal*, 1928) give 12 analyses of various tapioca flours. It is sufficient to note that all are high in carbohydrates, ranging from 79 to 90 per cent., while the percentages of oil and protein are very low. Three samples contained rather high proportions of earthy matters, an undesirable feature that buyers evidently need to watch.

Four older German analyses⁽¹⁾ showed carbohydrates ranging from 75 to 80 per cent., proteins 1 to 3½ per cent., and fibre 4 to 6 per cent.

Four recent analyses quoted by Hansson⁽⁵⁾ show an average of 81 per cent. carbohydrates, 1·8 per cent. protein, and 2·2 per cent. fibre.

Henry and Morrison ("Feeds and Feeding") give the following analysis of cassava (tapioca) starch refuse :—

	Per cent.
Moisture	12·0
Ash	1·6
Protein	0·8
Fibre	6·1
Carbohydrates	78·8
Oil	0·7

The material used in the test at Harper Adams College, here reported, was of the following composition :—

	Per cent.
Moisture	12·1
Ash	1·9
Protein	3·1
Fibre	1·7
Carbohydrates	80·6
Oil	0·6

In the main these two analyses agree closely, the only appreciable differences being in the case of the fibre and protein. In the samples quoted by Smetham the fibre ranged from ·07 to 5·47 per cent., and the protein from 0·12 to 3·00 per cent.

Previous Work on Pig-Feeding with Cassava (Tapioca).—Most of the previous work recorded appears to relate to the feeding of cassava (tapioca) as cassava roots and, therefore,

is not strictly comparable with the present experiment, but may be briefly summarized for information.

At the Hawaii College of Agriculture, Henke (²) found that—

- (1) 1 lb. of cassava meal was equal to 1.8 lb. of sweet potatoes.
- (2) Cassava meal was equal in value to corn (maize) when fed in equal parts with it.
- (3) Cassava in a fresh state as 50 per cent. of the ration (dry matter basis) produced scour in pigs. When fed at the rate of 25 to 35 per cent. of the ration (calculated dry matter basis) it was found to equal corn (maize), or wheat middlings in feeding value.
- (4) Cassava meal self-fed in addition to a concentrated corn ration gave favourable results when compared with cassava molasses meal, and with pineapple meal.

Kraus (³), at the Hawaii Station, corroborated the conclusion that cassava meal was equal, pound for pound, to maize, calculated on a water-free basis, and not exceeding 50 per cent. of the ration fed. He also found that the meal was quite palatable to pigs.

Alcacid (⁴), in the Philippines, carrying out a three-lot test, found that, in addition to a common basal ration of rice bran and copra meal, cassava roots gave a gain approximately equal to that given by corn (maize), but less than that given by molasses. The return over feed cost was greatest with cassava roots.

Hansson (⁵) has reported favourably on experience in Sweden and Denmark with cassava refuse obtained in the manufacture of starch ("manioc bran"). The manioc meal was used to the extent of 30 per cent. of the total concentrates and gave favourable results both as regards growth and quality of pork. An inferior sample, with about 60 per cent. starch, proved only about 10 per cent. inferior to barley. He concludes that average samples with 70-75 per cent. starch are fully equal to barley in feeding value.

There appear to be no records of experiments carried out in Great Britain with this material.

The Test at Harper Adams Agricultural College.—*Live Stock.*—Two lots, each of eight pigs, were used for the test. The 16 pigs were purchased locally in two equal consignments. The first eight were pure-bred Large White, but the others, though of Large White type, had some admixture of Large Black blood from the dam's side. With the exception of four, all pigs in the lots were sexless. Two unsprayed gilts appeared in each lot. The experimental lots were drawn

with great care, to ensure that they were as closely comparable as possible in every respect that could be checked.

Rations.—A basal ration of barley meal, sharps, extracted soya bean meal and a mineral mixture, was common to both lots. In addition Lot I received maize meal, and Lot II received tapioca meal in the same proportion as the maize meal fed to Lot I.

At the commencement of the test, on March 13, 1928, the composition of the rations was as follows :—

	<i>Lot I</i>				<i>Lot II</i>			
	Per cent.				Per cent.			
Barley meal	38	..	38		38	..	38	
Sharps	33	..	33		33	..	33	
Extracted soya meal	16	..	16		16	..	16	
Minerals	3	..	3		3	..	3	
Maize meal	10	..	—		—	..	—	
Tapioca	—	..	10		10	..	—	

The rations were modified from time to time and, when the first draft of pigs was sent away on July 31, the composition of the rations was as follows :—

	<i>Lot I</i>				<i>Lot II</i>			
	Per cent.				Per cent.			
Barley meal	42.8	..	43.3		43.3	..	43.3	
Sharps	20.2	..	20.0		20.0	..	20.0	
Extracted soya meal	10.1	..	9.8		9.8	..	9.8	
Minerals	1.9	..	1.9		1.9	..	1.9	
Maize	25.0	..	—		—	..	—	
Tapioca	—	..	25.0		25.0	..	—	

These two sets of figures give the range of the rations in the 22 weeks. All changes were made gradually, and the proportions of maize and tapioca were always kept equal.

Foods.—The following brief notes will serve to characterize the foods used :—

Barley Meal.—This was a local product, stone-ground from pure high-grade English feeding barley. Average cost, £12 11s. 0d. per ton.

Sharps.—A non-floury offal, of a proprietary brand, and throughout very uniform in character. Average cost, £10 16s. 8d. per ton.

Tapioca meal.—Variety known to the trade as “B.3.” An almost white floury product, rather dusty in character. Average cost, £9 10s. 0d. per ton.

Maize meal.—A fine-grade, freshly-ground yellow meal from River Plate maize. Average cost, £12 0s. 0d. per ton.

Extracted Soya meal.—An average sample of the commercial product supplied by a Hull firm. Average cost, £12 2s. 6d. per ton.

Mineral mixture.—Home-mixed, as follows: 1½ cwt. ground limestone, 1½ cwt. sterilized steamed bone flour, ½ cwt. fine grade cheese salt. Average cost £9 6s. 8d. per ton.

General Management.—The test started on March 13, 1928, and ended on September 10, 1928. The pigs were weighed each Tuesday morning prior to the morning feed. They were housed in open-fronted sties, but were given liberal opportunities for exercise each day in open yards, where they received some green food and occasionally a little small coal or ashes. During the warm weather in the latter part of the summer, the animals spent most of the day in the yards and remained in excellent health.

For some reason, undetermined, both lots of pigs proved to be very "dainty" eaters, and any changes in either the amount or composition of the rations had to be made with the greatest caution. They grew rather slowly, with poor weekly increases, there being a correspondingly high figure for consumption of food per lb. live-weight increase. Nevertheless, the tapioca lot gained gradually upon the maize lot, and at the end of 22 weeks they were, on the average, 14½ lb. per head the heavier.

In general, there was no appreciable difference between the two lots as regards coat condition, such little difference as appeared being in favour of the tapioca-fed pigs. During the last week of the test, a slight rash appeared on the bellies of the maize-fed pigs, but appeared to be of no serious consequence.

There was never any trouble with the palatability of the tapioca meal. Further, it mixed well, although its dusty nature made it rather unpleasant to handle. It had neither costive nor scouring effect on the animals. The food of each lot was fed as a slop made with water. At the outset the meal was mixed with, roughly, four times its weight of water, the proportion of water being gradually reduced in the course of the test.

At the end of 22 weeks seven pigs, *viz.* three from the maize-fed lot and four from the tapioca-fed lot, were sold for bacon. No further change in the composition of the rations was made after that date, the remaining pigs being retained for a further four weeks.

The animals, when ready for slaughter, were sent to Messrs. Marsh & Baxter, Ltd., of Brierley Hill, who gave every facility for seeing the pigs weighed alive and dead, and later afforded opportunities for the inspection of the bacon and hams.

Results.—The following table summarizes the salient points of the test:—

	Lot I <i>Maize meal</i>	Lot II <i>Tapioca meal</i>
Total gain, live-weight	1404.25 lb.	1510.50 lb.
Total food	5789.50 lb.	6196.00 lb.
Food per lb. Live-Weight increase	4.12 lb.	4.10 lb.
Total cost	£30 13s. 3d.	£29 19s. 10d.
Cost of food per lb.	1.27d.	1.16d.
Cost of food per lb. L.W.I. ..	5.24d.	4.76d.
Average L.W.I. per pig per day ..	1.02 lb.	1.12 lb.

As regards carcass percentage, the following figures indicate that the tapioca feeding gave carcass percentages fully as good as those given by the maize feeding.

Lot	Carcass percentage
Maize	80.49
Tapioca	81.37

It should be explained that these carcass percentages are calculated on the live-weight of the animals at the factory immediately before killing, after a full day's fast.

Discussion of Results.—The average rate of live-weight increase was rather disappointing in each lot, and, although it is a little the better in the case of Lot II, the difference is not sufficiently great to warrant any claim that tapioca is actually better than maize for fattening purposes. It will be noted, indeed, that the weights of each ration required to produce one pound of live-weight increase are practically the same for each lot. It is in the cost, however, that the most noticeable difference is apparent, for whereas a pound of the average mixed meal fed to Lot I cost 1.27d., in the case of Lot II this figure is 1.16d. When the cost of food per lb. live-weight increase is investigated, it is found that there is a difference of $\frac{1}{2}$ d. in favour of the tapioca-fed animals.

General Observations.—Inspection of the fresh carcasses showed that the fat of the tapioca-fed pigs was in every way satisfactory—of requisite and even thickness, white and firm. It was judged to be of a better colour than that of the maize-fed pigs. The cured bacon was of better quality in the case of the tapioca-fed pigs. The proportion of lean to fat was not noticeably better, but the texture, colour, and freedom from taint of the fat and the flesh left little to be desired. On further keeping for a period of six weeks, there was no deterioration.

As regards quality in the hams, there was less difference between the two lots than in the case of the bacon. Both

sets of hams were of good quality, but there was no outstanding ham in either lot. Except in two cases, both of which were hams from maize-fed pigs, no distinct taint could be detected, and the prevailing colour of the fat was a pale yellow.

These opinions, based upon inspection, were fully confirmed by cooking tests made at the College. Opinion at the breakfast table was unanimous as to the superiority of the tapioca-fed over the maize-fed bacon.

Iodine Values of the Bacon Fats.—After slaughter, samples of fat were taken from the various pigs and the iodine value of each sample determined, with the following results :—

<i>Lot</i>						<i>Iodine value</i>
Maize ..	..	..	..	..	..	65.63
Tapioca ..	..	..	..	..	..	61.84

Both figures must be regarded as rather high, but the advantage clearly lies with the tapioca lot, thus confirming the opinion formed on inspection.

Summary.—The main conclusions from the test are as follows :—

- (1) High-grade tapioca meal has proved to be satisfactory as regards palatability and other dietetic properties.
- (2) It may be regarded as suitable to replace maize or barley meal up to at least 25 per cent. of the total ration.
- (3) The bacon and hams resulting from tapioca-fed animals are of distinctly better quality than those from maize-fed pigs.
- (4) At current prices, the use of tapioca meal in place of maize or barley effects a sensible reduction in the cost of feeding.

ACKNOWLEDGMENTS.—Thanks are due to Dr. C. Crowther for his valuable help throughout; to Messrs. Marsh & Baxter for facilities for examination of carcasses, bacon and hams; and lastly to Messrs. W. H. Radford and T. O. Wilson, of the Chemical Department of the College, for various analyses of raw materials and fats.

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SEED WHEAT IN EASTERN ENGLAND

FOLLOWING on the investigations carried out in certain of the Eastern Counties in the autumn months of 1925, 1926 and 1927, for the purpose of collecting information as to the quality, variety and other characteristics of the seed wheat sown in this area, a further inquiry, on similar lines, was carried out during the autumn of 1928. The results of the 1925 and 1927 investigations, which were published in this JOURNAL (April, 1926, p. 15 ; and July, 1928, p. 299), suffered from the fact that, owing to various circumstances, it was found impossible to collect a large enough number of samples to be thoroughly representative of the whole of the seed wheat sown in this area. The information obtained, however, was considered to be of sufficient value to justify a repetition of the inquiry last autumn. The area under wheat in the district under survey approaches 280,000 acres, and consequently, in connexion with the following account of the 1928 inquiry, it should be borne in mind that the number of samples secured, *viz.*, some 478, represents but a small proportion, probably about 5 per cent., of the total number of bulks of seed wheat used.

The area covered included the whole of Cambridgeshire (excluding the Isle of Ely), Huntingdonshire, Hertfordshire, the northern and western parts of Essex, and the greater part of Suffolk. Four inspectors of the Ministry were detailed for this investigation, each working from a different centre. Further, each visited as many farms, both large and small, within his defined area, as was possible during the comparatively limited period for which he could be spared for this inquiry. As far as possible, samples were drawn from bulks of seed that were actually in process of being drilled, but in many cases it was found necessary to take samples from bulks that were stored ready for drilling at the first suitable opportunity.

Varieties.—The varieties which occurred with the greatest frequency during the course of the survey included Little Joss (85 samples), Squarehead's Master (56 samples), Renown (50 samples), Yeoman and Yeoman II (43 samples), Victor (34 samples), Red Standard (26 samples), Wilhelmina (20 samples), Rivet (20 samples), Bacton Champion (15 samples), Million III (9 samples), Setter (8 samples), Cambridge Browick (8 samples) and Bacton Masterpiece (7 samples). Other varieties

which occurred were Danish Chevalier, Carter's Red Standup, Millennium, Swedish Iron, Harvester, Fox, Squarehead's Master II, Leighton's 1927, Brooker's White Standup, Yeoman King, John Bull, Bacton Success, Yeoman Masterpiece, Premier, Squarehead's Success, April Bearded, Red Admiral, Marshal Foch, Ideal and Toogood's Success.

In 19 cases it was found that a mixture of two or three varieties was being sown. The addition of a strong strawed variety to prevent the crop from lodging was one reason given for this practice. Another reason was that in some seasons one variety seems to do better than another, and it is thought that by mixing the seed one variety is sure to do fairly well. The question of irregularity of ripening, and difference in length of straw does not appear to receive adequate attention.

On most of the farms where there was a considerable acreage of wheat it was generally found that several varieties were being grown. The reasons given for this were various. In some cases experience has shown that whilst one variety of wheat can be sown with success on fallow land, it is usually better to grow a different variety on land after clover. In other cases the reason given was that there did not seem to be much difference between the varieties, sometimes one variety and sometimes another doing best. Other farmers were always keen to try new varieties, and frequently asked if any other varieties could be recommended.

The large number of varieties met with in the course of this investigation emphasizes the value of the work of the National Institute of Agricultural Botany in conducting accurate trials, and in arranging for observation plots in many districts, with those varieties about which there is a lack of reliable information.

Source of Supply.—Of the 478 samples taken, no fewer than 310 were of home-grown seed. Of these 310 lots 98 were from crops grown from seed purchased the previous year, 112 had been on the farm for two years or more—some having been grown on the farm for over 20 years—while in 100 cases no information was available as to the length of time the stock had been on the farm. Of the remaining 168 samples, in 92 cases the seed had been purchased from merchants; in 65 it had been obtained from neighbours; and in the remaining 11 the source of the seed was not ascertained.

Purity.—Each of the samples taken was examined for purity. Only 19, or 4 per cent. of them, were of or above 99·5 per cent. purity; 291 others gave purity results above 97 per cent.; 150 fell between 94 and 97 per cent.; and the remaining 18 samples were of less than 94 per cent. purity.

In this connexion, it is fair to point out that, owing to the very dry weather at harvest time, the grain was generally hard and liable to break during thrashing. Many of the samples contained a noticeable proportion of broken seeds and, although in some cases collectors were informed that it was the farmer's intention to winnow the grain before it was drilled, it was found that the samples actually taken from the drill contained approximately the same percentage of impurities as those taken in the barn.

Six of the samples were found to contain Ergot (*Claviceps purpurea*), and Ear Cockles (*Tylenchus scandens*) occurred in four others.

Germination.—The samples having a germination of 99 per cent. numbered 149; 193 others gave figures of 97 or 98 per cent.; 104 were between 90 and 96 per cent.; and 32 fell below 90 per cent. After the exceptionally favourable harvest weather in East Anglia last year, a higher level of germination might have been expected. It has been suggested that the explanation, in part at least, may be that farmers were anxious to cut and save the crops before the weather broke, and that, in consequence, some corn was cut before it was fully matured, while some was carted too soon and heated in the stack. In either case, the result would be to lower the germinative capacity of the seed.

Bunt or Stinking Smut (*Tilletia tritici*).—Of the 469 samples examined for the presence of bunt, 67 showed no trace of spores when examined under the microscope; 298 were slightly infected with spores; 56 were more heavily infected; and 46 contained unbroken bunt balls.

Copper sulphate was the material most commonly used for treatment against bunt. Inquiry was made in 464 cases, and it was found that in 244 of them copper sulphate had been employed. Formalin was the dressing used in 25 instances and copper carbonate was found only once. Several varieties of proprietary articles were, of course, encountered. In 21 cases the farmer did not propose to give any treatment.

Comparative Quality of Home-saved Seed.—In order to afford some comparison between the quality of the home-saved seed and that of the seed obtained from merchants, the majority of the samples collected were subjected to a grading test. For this purpose the samples were classified (with regard to the percentage of small seed—including small shrivelled seed—the percentage of sprouted seed, the percentage of weed seed and crop seed impurities, and general appearance) into four groups, namely, "good," "satisfactory," "poor" and "very poor." Of the 86 samples of seed, obtained from merchants, which were examined for this purpose, 39 per cent. were graded as "good," 34 per cent. as "satisfactory," 14 per cent. as "poor," and 13 per cent. as "very poor." Of the 296 samples of home-saved seed which were classified, 8 per cent. were graded as "good," 46 per cent. as "satisfactory," 24 per cent. as "poor," and 22 per cent. as "very poor." Taking the samples as a whole, including some the origins of which were not ascertained, 15 per cent. were graded as "good," 43 per cent. as "satisfactory," 23 per cent. as "poor," and 19 per cent. as "very poor."

Each of the farmers who were good enough to allow samples to be taken from their bulks of seed has been furnished with a report upon his sample. Apart, therefore, from any general value which the results of this investigation may have, there is reason to believe that it will have helped to stimulate the interest of those farmers who were visited in seed selection and seed testing.

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IRRADIATION OF FATTENING CATTLE BY A MERCURY VAPOUR LAMP

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THE therapeutic value of sunshine has long been realized, but recent experiments have shown the value of irradiation produced by artificial means when used for animals kept in unnatural surroundings—and particularly when the animals are fed on a ration deficient in certain vitamins.

Henderson and Magee, working at the Rowett Research Institute, Aberdeen, showed that the exposure of pigs and lactating goats to ultra-violet rays from a carbon arc lamp produced increased calcium and phosphorus assimilation when the ration used was deficient in these minerals. It has also been found that summer-produced milk has a higher anti-rachitic value than milk produced during the winter, when the cows are receiving little or no natural sunshine.

These and other experiments led the writer to consider whether animals housed during the greater part of the winter months would not also benefit from exposure to artificial irradiation.

In Scotland cattle frequently spend the five or six winter months indoors and, especially in the case of fattening cattle, get very little opportunity of benefiting from any winter sunshine otherwise obtainable. An attempt was therefore made to discover what, if any, benefit exposure to the rays of an ultra-violet ray lamp would be obtained by cattle as kept on the average farm.

It was arranged to try the experiment first during the winter of 1926-27, and a small cattle court was chosen for housing the beasts. It had stone walls and a corrugated iron roof and was lit by roof lights with ordinary glass so that any natural ultra-violet rays from outside sunshine did not penetrate. The court was divided in two by a sparred fence with a feeding passage running the breadth of the two divisions. About the centre of one division, a mercury vapour lamp (Kelvin, Bottomly and Baird) consuming 500 W. at 250 volts was hung, with the resistance coil placed in the rafters and the lamp suspended therefrom to within about six feet of the ground. The height from the ground had to be increased as the cattle grew, in order to keep it at a safe distance.

The cattle were from 7 to 9 months old when the experiment commenced, at the end of October, 1926, and had been bred

and suckled on two neighbouring farms. The dams were cross Shorthorn cows, and a pedigree Aberdeen-Angus bull was the sire of two of the calves, the remaining four having been sired by a pedigree Shorthorn bull. The calves were weighed and divided into two groups, one A.A. and two Shorthorn crosses in each group, selected according to weight and sex, each group including one heifer. The total weights of each group showed a difference of only 6 lb.

The calves weighed 4 to 5 cwt. each and were all in good condition when the experiment commenced. Irradiation was started with 10 minutes exposure and increased 10 minutes daily until they were receiving $1\frac{1}{2}$ hours exposure each day. No signs of erythema or discomfort were shown by any of the animals, and though at first they showed a tendency to look directly at the light, they soon got so accustomed to it that they took very little notice when it was switched on, except in showing a distinct preference for lying directly under the lamp.

The lamp was shaded with a metal shade on the side nearest the other division in order to prevent any rays, however distant, reaching the control group. After a month the exposure was increased from $1\frac{1}{2}$ hours to 2 hours per day.

Each group received the same amount of turnips, hay, oat straw, cake and rock salt, which was increased equally to the two groups. The cattle were weighed every fortnight, before the morning feed, the weighing being done on a steelyard with a frame attached. By the middle of April, when the experiment finished, the group getting the ultra-violet ray treatment was 83 lb. ahead of the other group and the cattle were considered to have a somewhat better "bloom," though this was not very noticeable.

This result was not held to be sufficiently definite, and it was decided to repeat the experiment the following winter. The same cattle court was used, but an additional sparred pen was made inside the division for the irradiated group, and over the centre of this pen the mercury vapour lamp was placed. This was done in order to keep the cattle nearer the lamp and, it was hoped, so increase the value of the irradiation.

Four beasts were placed in each group, having been divided according to weight. All were A.A. crosses except one roan Shorthorn cross which was in the non-irradiated group. There were among the eight beasts two second cross A.A.—Highland calves, and one was placed in each section.

The cattle were again suckled calves from the same farms as the previous year's groups. Both lots started fairly evenly as to condition and weight, there being a difference of only 12 lb. between the totals of the two groups when the experiment commenced on November 15.

The lamp was left on for one hour each day, starting with 5 minutes and increasing 10 minutes daily, and while getting the treatment the cattle were shut into the inner division, which, as it was only 13 ft by 9 ft., kept the four beasts fairly near the lamp, which was about 6 ft. from the ground.

No bad effects were noticed, and the weighings were carried out as before. The irradiated group fell behind steadily, and by April 1 the difference in weight was 92 lb. in favour of the non-irradiated group

The 1926-27 experiment lasted approximately one month longer than the 1927-28 experiment. The following Table shows the individual gains for the two experiments :—

1926-27		1927-28	
<i>Group 1</i>	<i>Group 2 Irradiated</i>	<i>Group 1</i>	<i>Group 2 Irradiated</i>
256 lb.	212 lb.	172 lb.	161 lb.
204 lb.	316 lb.	159 lb.	130 lb.
235 lb.	250 lb.	151 lb.	124 lb.
		184 lb.	159 lb.
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695 lb.	778 lb.	666 lb.	574 lb.
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The results appear to contradict each other, but may have been caused by the chance group of the cattle, but they also seem to indicate that exposure to artificial ultra-violet rays without the other accompanying benefits of natural sunshine is not of value to cattle kept under ordinary farm conditions and fed on the average farm rations.

About the same time as these experiments were being carried out, Hart and co-workers in America carried out a metabolic experiment with cows exposed to an ultra-violet ray lamp. They too found that no benefit was derived, although previously they had got similar results to Magee and Henderson when working with goats; and, in 1925, found that direct sunlight reduced the negative balance of calcium and phosphorus in milking cows though it did not produce a positive balance.

In the experiment of Hart and his co-workers in 1926, three Holstein cows, two with mainly white backs and one with a black-haired back, were kept for a pre-period of three weeks in a basement with closed windows and lit by

ordinary electric light bulbs. The cows were fed on silage, lucerne hay, maize, bran, oilmeal and salt. For four weeks irradiation was given one hour daily, at 22 ft. distance from the back of the cows. No increased milk production or assimilation of calcium and phosphorus was found. The authors suggest that the thickness of hide may prevent the penetration of the rays and account for the lack of beneficial results, but end their paper by saying that "The data should not be interpreted as indicating that exposure of the dairy cow to sunlight is not beneficial."

Both in the experiment with cows in U.S.A., and the experiment with fattening cattle described above, natural foodstuffs were used—having been grown in sunlight and neither treated chemically nor heated to any high temperature. This brings in the possibility of all the cattle receiving the benefits of sunshine by means of their food even though they themselves are not exposed to direct rays from the sun.

An experiment with poultry,* undertaken by Mercer and Tozer and inspected by Professor Leonard Hill, to compare the effects of irradiated foodstuffs and the direct irradiation of the birds, gave results showing that a well balanced ration is not benefited by ultra-violet ray irradiation; in fact, in that case it appears to have had a depressing effect.

The most beneficial effect obtained at the Rowett Research Institute from artificially produced ultra-violet rays was with animals whose diet was deficient in calcium and phosphorus; and though the milk cows in U.S.A. showed a negative balance in most cases, they were not on a strikingly deficient diet nor were the fattening cattle in the experiment described above.

The results generally appear to show that fattening cattle are seldom likely to suffer from a marked deficiency of calcium and phosphorus when partially fed on home-produced foodstuffs; also that natural sunshine has some beneficial effect which cannot at present be entirely reproduced by artificial means.

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* See this JOURNAL, October, 1927, p. 624.

TAR-DISTILLATES FOR THE WINTER SPRAYING OF APPLES IN NORTH-WEST ENGLAND

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It is now several years since tar-distillates were introduced into this country for the purpose of spraying dormant fruit trees, and a considerable amount of experimental and demonstrational work has been carried out on their use in various parts of England. In general, it has been shown that against aphids and apple sucker they possess good destructive qualities. Some control of caterpillars has also been obtained, but the results as regards capsid control are variable and by no means well defined.

Many brands of tar-distillates have been placed on the market, and already the grower has a wide range of choice. Each year, however, sees the introduction of further brands, and growers are interested in knowing whether these substantiate the claims made for them and compare favourably with the older ones. During 1928, trials were carried out at four centres in Lancashire and three in Cheshire, in co-operation with the County Horticultural Staffs, and six washes were used. Two of these—"Carbokrimp" and "Mortegg"—were selected from those introduced early in the history of tar-distillate washes in this country, and three others—"Sterilite," MacDougall's Tar Oil Winter Wash and "Abolene"—were more recently introduced. In each case the wash was used at a strength of $7\frac{1}{2}$ to 8 per cent., which is not necessarily that recommended by the makers concerned, and the sprays were mixed and applied under proper supervision. In addition to the five tar-distillate sprays, washes containing di-nitro-ortho-cresol (D.N.C.) were also tested at three of the centres. This compound, which is known to have considerable egg-killing properties, was supplied from Rothamsted Agricultural Research Station in the form of stock solutions, and was diluted to give a spray fluid containing 0.25 per cent. di-nitro-cresol.

Thanks are due to Mr. N. J. Macpherson and Mr. W. L. Steer, of the Lancashire Horticultural Staff, and to Mr. W. E. S. Cooper, F.R.H.S., Horticultural Superintendent for Cheshire, for the great care and attention which they gave to the preparation and application of the sprays and other details of the trials at the centres under their supervision.

Soil, Climate and Types of Orchards.—The conditions of heavy rainfall, a short season and lack of sunshine have reacted unfavourably upon fruit culture in the north-western counties, and the result is that out of a total of something like 1,250,000 acres under cultivation, only a very small proportion, some 5,000 acres, is under orchards, this area being more or less equally divided between Lancashire and Cheshire.

The three centres in Cheshire were situated on drift sand and glacial deposits, the soils being sandy or silt with sand. The plantations were under 15 years old and had been laid out for commercial work. In Lancashire three of the centres were on loams of the triassic system and the fourth on a medium loam overlying coal measures. Two of the plantations were 10 to 15 years old, and two were 15 to 20 years; two were demonstration plantations properly sprayed, pruned, and cultivated each year, and one of the other two had been more or less neglected and had received little or no cultivation for some years. Of the seven plantations, four were arable and three were grass; three were situated fairly high upon rising ground and four were on the plain. At two of the centres the trees were half-standards; at five they were mixed half-standards and bushes, three of them being interplanted with bush fruit. The annual rainfall in the Cheshire region varies from about 26 to 30 inches, and in the mid-Lancashire region from 32 to 40 inches. The relative humidity during January and February varies from about 75 per cent. in the south to about 85 per cent. in the north: moreover, the months of January and February are months of heavy rains, a factor which has a distinct bearing on the efficiency of spraying operations. The whole region is subject to late frosts and cold winds, with rain in the early spring.

These details regarding the conditions under which the sprays were used are given to indicate the variety of local conditions at the seven centres, and suggest that a spray which gives satisfaction under all these circumstances is likely to prove fairly efficient under any of the usual conditions met with on commercial holdings.

The varieties of apples which figured principally in the trials were Bramley's Seedling, Lane's Prince Albert, Grenadier, Grosvenor, Early Victoria, and Allington Pippin, these being the varieties most commonly met with on commercial plantations in the district.

Notes on Mixing and Spreading.—A characteristic feature of the sprays selected was the general excellence of the mixing and wetting power. Some variation in colour was noticeable when the sprays were mixed, but the majority were white, the chief exception being D.N.C. which was a bright orange yellow.

Measurement of Results.—The sprays were usually allotted on the chequer-board system, but, where this was not convenient, the plantation was otherwise divided to receive the sprays, so that each spray occurred from 2 to 12 times according to the size of the plantation.

In April and early May each plantation was visited and the trees examined for the occurrence of the different insect pests. Marks were allotted to the sprays in the following manner. Where each opening flower truss or young shoot examined was infested with the pest, a mark of 10 was allotted, and when all the shoots which were examined were entirely free from infestation, 0 was recorded. Where only one shoot or truss was infested with only one insect, "trace" was recorded, and this trace is taken as having the numerical value of 0.5 for convenience in totalling the points against each spray. In the case of Winter Moth, where there is only one generation a year, a "trace" may be negligible, but in the case of aphides a "trace" is by no means negligible, because of the rapidity with which these insects multiply.

Where the trees were small enough to permit it, practically every shoot and truss was examined. With larger trees the branches which could be conveniently reached from the ground were examined, but with tall trees, where the branches were out of reach, steps were used during the inspection. Although this method of allocation of marks can by no means be considered as mathematically accurate, the repetition of the plots and the numbers of the centres give the method a certain value, and the figures so obtained reflect the comparative values of the sprays.

Observations were made on five pests: aphides, apple sucker, apple capsids, tortrix larvæ, and the larvæ of the winter moth and its allies. Since all the pests were not present at each centre, one advantage of taking a number of centres is that records of each pest, from one centre or another, are available for all the sprays used.

Control of Aphides.—Table I gives the records for aphid occurrence at the various centres. The figures under the various

centres represent the totals of the plot infestation figures. The grand total is then found, the average per centre worked out, and the final column indicates the actual amount of control represented, as based on records from 36 to 46 plots of from three to eight trees each.

TABLE I.—CONTROL OF APHIDES.

<i>Spray</i>	<i>Centre</i>			<i>P.</i>	<i>Total</i>	<i>Average</i>	<i>Per cent. control indicated</i>
	<i>N.</i>	<i>H.</i>	<i>S.</i>				
Check (unsprayed)	80.0	87.0	61.0	30.0	258	64.5	—
Abolene ..	0.0	4.5	0.5	—	5.0	1.6	97.6
Carbokrimp	1.0	3.5	0.5	4.5	9.5	2.4	96.3
D.N.C. ..	6.0	9.0	0.0	—	15.0	5.0	93.5
MacDougall's	0.5	5.0	4.0	—	9.5	3.2	95.9
Mortegg ..	0.0	2.0	0.0	5.0	7.0	1.75	97.3
Sterilite ..	1.5	1.5	0.0	4.0	7.0	1.75	97.3

The most significant column in the table is that indicating the percentage of control obtained. The figures reveal that the degree of control is over 90 per cent. throughout the trials, and there is a difference of only 4 per cent. between the extremes. For aphid control D.N.C. appeared to be practically as effective as the tar-distillates.

Apple Sucker Control.—Apple sucker was not generally prevalent at any of the centres in 1928, hence the figures for the pest are low.

TABLE II.—CONTROL OF APPLE SUCKER.

<i>Spray</i>	<i>Centre</i>			<i>R.</i>	<i>Total</i>	<i>Average</i>	<i>Per cent. control indicated</i>
	<i>N.</i>	<i>P.</i>	<i>K.</i>				
Check (unsprayed)	15.0	31.0	18.0	13.0	77.0	19.2	—
Abolene ..	0.0	—	1.5	3.0	4.5	1.5	91.3
Carbokrimp	0.0	3.5	2.0	1.0	6.5	1.6	91.6
D.N.C. ..	1.0	—	—	—	1.0	1.0	93.4
MacDougall's	0.5	—	—	—	0.5	0.5	96.7
Mortegg ..	0.0	3.5	0.0	1.5	5.0	1.25	93.5
Sterilite ..	0.0	7.5	1.5	1.0	10.0	2.5	87.0

The amount of control obtained was over 85 per cent. in every case, and the difference between the extremes was about 10 per cent. D.N.C. showed up favourably against apple sucker at the centre where it was used.

Influence on Capsid Bug and Red Spider.—The uneven distribution of these two pests in the plantations where the trials occurred, renders it exceedingly difficult to form reliable conclusions as to how far they are influenced by spraying

with tar-distillates. The scant knowledge thus far collected on the species and habits of the capsids infesting fruit trees in the area adds to this difficulty. The figures obtained from the trials indicate a certain value in favour of the sprayed plots in the three northern centres where the pest occurred, but this is not supported by the results obtained in Cheshire where, at the one centre on which capsids were present, the infestation appeared highest on the sprayed plots.

TABLE III.—APPLE CAPSID BUG CONTROL.

<i>Centre</i>		<i>Sprayed</i>		<i>Unsprayed</i>
P.	.. ..	6.2 per cent.	..	12.5 per cent.
K.	.. ..	2.5 "	..	15.0 "
R.	.. ..	4.5 "	..	12.5 "
Average	.. ..	4.4 "	..	13.3 "

Red Spider occurred to a noticeable extent at two centres only, and the distribution of the pest was uneven. In both cases the figures obtained were inconclusive.

Influence on Winter Moth and Tortrix Caterpillars.—Tar-distillates have been known for some little time to exercise a controlling influence on caterpillars, and in these trials an effort has been made to distinguish between the caterpillars of the Winter Moth and its allies and those of the Tortrix moths and their allies.

The majority of the eggs of the Winter Moth and the Mottled Umber Moth are likely to be deposited before the application of the spray, and will therefore be affected to the fullest extent. The eggs of the March Moth, however, are not likely to be laid until after the spray is applied, and the only influence at all possible is a residual one, which may or may not be detrimental. Assuming these three species to be present in equal numbers, the highest control efficiency expected would be two-thirds, or 66 per cent., if the larvæ of the Winter and Mottled Umber Moths were completely destroyed. Examination of the figures in Table IV shows that an average of 73.6 per cent. control was obtained, the lowest percentage of control secured by any spray being 67.9 per cent. and the highest 83.8 per cent. The comparatively close correspondence of the control figures for all the washes suggests that they all exercise a very definite controlling influence, the small differences being probably due to experimental error and local differences in the distribution of the species.

TABLE IV.—WINTER MOTH CONTROL.

Spray	Centre			P.	Total	Average	Per cent. control indicated
	N.	H.	S.				
Check (unsprayed)	39.5	58.0	18.0	20.0	135.5	33.9	- -
Abolene ..	4.0	10.0	5.5	—	19.5	6.5	83.1
Carbokrimp	14.0	11.0	3.5	10.0	38.5	9.6	71.6
D.N.C. ..	20.0	13.0	4.5	—	37.5	12.5	67.6
MacDougall's	6.5	11.0	3.0	—	20.5	6.8	82.3
Mortegg ..	7.0	3.0	3.0	9.0	22.0	5.5	83.8
Sterilite ..	10.0	13.5	3.0	10.0	36.5	9.1	73.2

With the tortrix moths the most common species in the area in 1928 were *Cacaecia rosana* L., *C. podana* Sc., and *Argyroplote ochroleucana* Hb., all of which appear to spend the winter as young larvæ about the trees. The thorough soaking of the tree with spray fluid renders it likely that the spray reaches the young larvæ in their hibernation sites and affects them adversely. That this is what happens appears evident from Table V.

TABLE V.—TORTRIX MOTH CONTROL.

Spray	Centre			P.	Total	Average	Per cent. indicated control
	N.	H.	S.				
Check (unsprayed)	36.0	39.0	21.5	12.0	108.5	27.1	- -
Abolene ..	3.0	6.5	5.5	—	15.0	5.0	84.5
Carbokrimp	1.0	3.0	5.0	1.0	10.0	2.5	90.8
D.N.C. ..	3.0	1.0	3.0	—	7.0	2.3	92.75
MacDougall's	3.0	2.0	7.5	—	12.5	4.1	86.1
Mortegg ..	2.0	2.5	5.5	2.0	12.0	3.0	88.9
Sterilite ..	3.5	6.5	5.5	4.5	20.0	5.0	81.6

The average control for the sprayed trees is 87.44 per cent., which indicates a very satisfactory control of a pest which, in the past, has been exceedingly difficult to combat. The fact that a number of Tortrix moths and their allies are involved, and that these probably have different habits as regards overwintering, is sufficient to account for the failure to secure a still more efficient control.

Influence on the State of the Fruit at Harvest.—Fruit which has been injured by insect attack during the growing season may be shed before the harvest, and hence the condition of the fruit which is gathered will give only a partial indication of the extent to which insect injury has occurred, while the shedding of the fruit from sprayed and unsprayed trees alike will tend in some measure to even up the proportion of clean fruit produced. At several centres, the fruit was critically examined at picking time to determine to what extent the

value of the spraying with tar-distillate was reflected in the quality of the fruit. The figures in Table VI show that the sprayed trees produced a matter of 10 per cent. more clean fruit than those which had been left unsprayed.

TABLE VI. PROPORTION OF CLEAN FRUIT AFTER SPRAYING.

Plot	Per cent. injured by			Per cent. of clean fruit
	<i>Aphis</i>	<i>Capsid</i>	<i>Caterpillar</i>	
Check (unsprayed) . .	9.3	1.4	13.0	76.3
1 	2.4	2.1	8.5	87.0
2 	3.5	2.1	9.2	85.2
3 	2.6	1.7	9.4	86.3
4 	2.5	1.7	9.5	86.3
5 	2.6	1.6	8.4	87.4

Influence on Yield and Vigour.—It is generally recognized that tar-distillate washes have a marked influence on the vigour and appearance of the foliage. In the trials herein described the improved appearance of the foliage was very noticeable. In order to form some idea of the extent to which increased vigour was accompanied by increased yield the fruit from some sprayed and unsprayed plots was weighed. The variation in the yields from the several sprayed plots seemed due to local differences rather than the result of the respective sprays. From two unsprayed plots of 12 trees each the average yield was 13 lb., while from six sprayed plots containing 12 trees each the average yield was 71½ lb., the sprayed trees thus producing over five times the amount of fruit yielded by those unsprayed.

Summary and Conclusions.—Table VII shows that all the sprays used in the experiments exercised very considerable controlling influence upon the pests concerned. The range of control for aphides varied from 97.6 to 93.5 per cent., and that for apple sucker from 96.7 to 87 per cent. Control of winter moths and their allies varied from 83.8 to 67.9 per cent., and of tortrix moths from 92.7 to 81.6 per cent. Di-nitro-ortho-cresol, which compared favourably with the other washes in the control of aphis, apple sucker, and tortrix, appeared rather less efficient in connexion with the control of winter moths.

TABLE VII.
SUMMARY OF RESULTS OF TRIALS, PERCENTAGE OF CONTROL.

Spray		<i>Aphis</i>	<i>Sucker</i>	<i>Winter</i>	
				<i>Moth, etc.</i>	<i>Tortrix, etc.</i>
Abolene 		97.6	91.3	83.1	84.5
Carbokrimp. ..		96.3	91.6	71.6	90.8
D.N.C. 		93.5	93.4	67.6	92.7
MacDougall's ..		95.0	96.7	82.3	86.1
Mortegg 		97.3	93.5	83.8	88.9
Sterilite 		97.3	87.0	73.2	81.6

With regard to the influence of local conditions on the efficiency of the tar washes, it was noted that higher control was secured in the Cheshire or southerly group of trials than in the Lancashire or northerly group. Higher control was evident in the plantations in the plain, although this may have been due to the weather conditions at the higher altitudes during the period immediately following the application of the sprays.

From the figures obtained in these trials, it is very difficult to draw practical conclusions for the assistance of growers choosing a spray from among the various brands of tar-distillates, for the differences in efficiency are small. In trials such as these there is considerable room for experimental error, and for differences in the thoroughness of application of the sprays, in the distribution of the pests, and in the distance from hedges, trees, and other sources from which re-infestation may take place. It is also difficult to maintain the same standards when measuring pest incidence through such an extensive series of trials. Small differences in the figures representing the efficiency of the various sprays used in these experiments cannot, therefore, be considered as expressing absolute differences in the efficiency of the sprays. The most that can be said is that great benefit is derived from the use of tar-distillate washes during the dormant period ; and that while the trials give some indication of the degree of efficiency resulting from the use of particular sprays, an important consideration when purchasing is the cost of the material. From among the range of consistently efficient brands the selection would, therefore, be governed by the price factor and the ease with which the spray could be obtained in quantities to suit the grower's requirements.

* * * * *

FARM ORCHARD RENOVATION IN DEVON

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and

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Condition of the Farm Orchard in Devon after the War.—

When a survey of farm orchards in the West of England was undertaken by the Ministry in 1919, it was found that the condition of the majority of the cider orchards in Devon left much to be desired. Indeed, 50 per cent. of them could yield but a small return.

In most instances the trees originally had been planted far too closely together, and as, by the terms of the leases, the tenant had to maintain the original number of trees per acre, the fault had been continued. The depreciated market value of cider, in conjunction with the shortage of labour due to war-time conditions, had resulted in a lack of interest in orcharding and the total neglect of the necessary orchard operations. The trees had consequently degenerated into thickets of dense matted branches covered with lichen and moss. The fallen and dead trees had not been removed, while the herbage had become coarse and rank, and valueless for grazing. Too often, vacancies had been filled with unsuitable trees which had never been pruned and had failed to form shapely heads, while in the early stages trees usually lacked protection other than that afforded by a bundle of thorns or a manure bag. The effect of this lack of early attention to the young trees was shown by the number which were barked and crippled by rabbits and live stock, and the fact that owing to the absence of stakes few of them had remained straight.

Change in the Outlook.—The conclusion of the war coincided with an increased demand for cider. This increased demand, coupled with other steps taken to foster the improvements in fruit growing, has made the farmer realize that his orchard should be an asset of considerable value. With this realization came a demand for advice and instruction as to the best methods to be adopted for renovation and for information on the best trees to plant. The supply of suitable young trees for filling gaps or for the planting of young cider orchards proved inadequate to meet the demand. For several years nurseries had concentrated on the production of culinary and dessert fruit,

and there was a dearth of suitable standard trees—especially of cider varieties—for grass orchard conditions, unless one prepared to take trees raised on the Continent. Quantities of Continental trees have been sent into the West of England, some of them proving unsatisfactory when planted in English farm orchards.

Co-operation of Interests.—The interests concerned were fully alive to this position, and as a result of thought and discussion the matter was brought to a head in Devon by Mr. Whiteway, who offered 100 guineas towards any practical scheme for farm orchard improvement. The immediate result was the establishment of a Joint Committee representative of the Devon Branch of the National Farmers' Union and the Devon County Agricultural Committee, and subsequently the inauguration of an orchard improvement competition which commenced in the summer of 1926. Later came a Conference at Exeter, which established a permanent Orchard Committee representing the following interests :—

- (1) Landowners' Association.
- (2) National Farmers' Union.
- (3) Cider Manufacturers.
- (4) County Agricultural Committee.
- (5) County Small Holdings Committee.
- (6) Judges and competitors in the Orchard Improvement Competition.
- (7) Nurserymen.
- (8) Long Ashton National Cider Research Institute.

Arrangements were made by the Committee for the extension of the existing manual process instructional classes in pruning, planting, protecting, spraying, and general orchard management. The publicity given to the proceedings of the Conference aroused the interest of the nursery trade to the possibilities of a growing demand for standard trees of cider varieties. A further result was the establishment of a scheme for the renovation and replanting of orchards on Devon County Council Small Holdings.

Orchard Improvement Competition.—This orchard competition to which allusion has been made is unique in that it is designed to take notice only of actual improvements ; there is no question of the best kept orchards monopolizing the prizes : indeed, such orchards are handicapped severely at the time of entry. The conditions of the competition provide an opportunity for the occupier of an orchard which, for example, may be only 20 per cent. effective, to win a cup by so improving

his orchard that, in the opinion of the judges, the biggest advance in condition has been made within a period of 12 months. It is manifestly difficult for the occupier of a well-kept orchard, which might be awarded 50 per cent. of the available marks at the first inspection, to improve that orchard so much in 12 months that its value is increased by a further 25 per cent. On the other hand, the occupier of an orchard which has been very badly neglected can, by judicious renovation, bring up the general standard of the orchard by as much as 40 per cent. in that period. As the competition has stimulated the levelling up of many orchards which were formerly ill-cared for, it has yielded very valuable results.

At the commencement of the competition in 1926 the county was divided into four districts (later reduced to three), in each of which two cups are offered for competition. Two additional open classes have since been arranged, where cups are awarded for the "best-kept orchards" this giving those competitors a chance whose orchards were at the outset too good for them to secure a trophy in the classes for orchard improvement. The only conditions of entry needing special mention are that 75 per cent. of the orcharding on any farm must be entered, and the orchard must contain 75 per cent. of cider fruit trees.

At the close of the past season there were 54 competitors. These included most of the original entrants in 1926, and it has been the experience of the judges that consistent progress has taken place in nearly all the orchards concerned.

System of Marking and Inspection.—During the months of July and August a competitor making his first entry is visited by a panel of judges, and his orchard is given points under various headings. When all the competitors have been visited, a summary of the suggestions and criticisms made by the judges is compiled and sent to each competitor for his guidance. This constructive criticism has resulted in a most astonishing response on the part of the individual competitors, and many visits have been followed by practical orchard management classes in the ensuing winter months. The competitor is revisited in the following July, his orchard again pointed, and his improvements and progress are discussed. The margin of improvement is taken as that shown by the increase in the number of points above those originally allocated. The maximum points are 200, allocated as follows:—

- (a) *General Arrangement and Spacing of Trees (maximum points 20).*—In an old-established orchard, it is not easy to alter the spacing of trees except by the gradual process of elimina-

tion as trees become worn out or are blown down. A considerable number of competitors have, however, removed derelict trees, filled existing gaps, and somewhat improved the layout.

- (b) *General Appearance and Condition of Growth (maximum points 30).*—The general condition of the newly-entered orchard is usually such that it rarely obtains half marks under this heading at the first inspection. In two years some remarkable alterations have been noted, after attention has been paid to such operations as pruning and spraying, manuring and better grazing of the grass, and trimming of overgrown hedgerows.

The competing orchards have increased in vigour and a healthier growth is usually noticeable.

- (c) *Staking, Tying, and Protection of Young Trees (maximum points 30).*—In the past, this item of orchard management has been either neglected or has resolved itself into the tying of a bundle of thorns around the trees, or at the most surrounding it with an inferior gauge wire netting insecurely fastened. The judges have invariably stressed the point that it is waste of time and money to plant a good young tree and not afford it reasonable protection against damage by grazing stock or rabbits, and that it is false economy to attempt to do this with anything but the best material. Under this heading the improvement shown has been very gratifying.

- (d) *Method of Pruning Established Trees (maximum points 30).*—In many of the competing orchards little pruning had been done for years, and often what had been done was done without consideration of the after effects. Largely as a result of practical classes held in the county this now shows a considerable improvement. One instance may be quoted where a cup winner, by removing 540 faggots of surplus wood from an orchard $4\frac{1}{2}$ acres in extent, increased his margin of points under this heading by 17 in one year!

It was often observed that trees planted within a few years previous to the competition had not been cut back to form a strong head after planting, and that as a result many had been spoilt. The suggestion made to competitors that the trees should be cut back twelve months after planting is now usually followed.

- (e) *Cleanliness of Trees (maximum points 20).*—Climatic conditions and neglect have combined to make this county notorious for the growth of lichen and moss in the orchards. The judges have repeatedly pointed out that such growth forms a harbourage for many noxious insect pests. Since few farmers at present possess a satisfactory spraying outfit little general improvement was expected in this direction. Nevertheless, results have exceeded expectations, although much remains to be done. The most popular and one of the most efficacious sprays is undoubtedly lime applied as hot as possible. The tar-distillate washes are costly to apply to an orchard full of big standard trees under Devonshire farming conditions. It has been encouraging to note the success with which some competitors have controlled woolly aphis on the smaller trees. The county now possesses a powerful spraying machine which can be obtained on loan, and competitors have taken full advantage of the opportunity offered.

- (f) *Condition of Grass, Fences and Hedges (maximum points 20).*—Some of the orchards when first entered in the competition were overgrown with bracken, thistles, nettles and other weeds. Others showed the need of draining, whilst many had been inadequately manured or improperly grazed.

Most of the competitors have made a distinct advance in this connexion, and in one or two instances the results have been revolutionary. Correct manuring, pruning which has let the sun reach the turf, and stocking orchards with sheep, pigs, and poultry, have worked wonders. In several instances the competitor has even undertaken substantial draining operations. The surrounding hedgerows have been trimmed, and big timber trees, growing in the hedges with detrimental effect to the fruit trees, have been cut down. The grazing value of the orchards is much improved, whilst the trees show a corresponding increase in growth and general well-being.

- (g) *Renovation by Planting and Head Grafting (maximum points 60).*—Points are not allocated in this section at the first inspection, and consequently it was expected that competitors would make the biggest advance in this work. Worn-out trees have been replaced and unprofitable varieties headed back and regrafted. It is, however, a matter for regret that in some instances the best possible type of young tree has not been purchased, and that a number of unthrifty new trees, some of foreign origin, have been encountered.

This competition has aroused much interest. Really useful renovation work is in progress, and this should have a cumulative value, not only to the individual competitor, but to the county. Further, it has created a widespread interest in orchard cultivation and management, and an appreciation of and increasing demand for demonstrations and classes by no means limited to competitors.

* * * * *

FRUIT MARKETING REFORM : TOMATOES AND CUCUMBERS*

THE glasshouse section of the fruit-growing industry of this country has already made notable progress in the technique of preparing tomatoes and cucumbers for market. In the definition of grades, and in the fixing of net weights and counts, some degree of standardization has been attained. In addition, almost complete standardization of a limited number of package types has been secured. It is notable that this position has been reached by glasshouse growers without external aid.

In practice, this standardization of method has been observed, with varying efficiency, by a fair proportion of the growers. What is needed now, however, is an extended standardization programme to which the industry as a whole conforms and in which the Ministry can intervene helpfully in the role of impartial supervisor.

Moreover, the English glasshouse industry is faced with keen and increasing competition from overseas sources of supply and cannot afford any laxity in marketing methods or to leave any stone unturned, not only to win the confidence of distributors, but to stimulate and sustain the interest of consumers in the home product.

Tomato and cucumber growers would, in fact, seem to be in a position to derive advantage from the application of the Agricultural Produce (Grading and Marking) Act, 1928, to their marketing activities. This Act empowers the Minister of Agriculture and Fisheries to define grades, to prescribe grade designation marks for graded home-grown produce and to draw up such conditions as may be necessary to regulate their application.

With this end in view, the following scheme has been prepared jointly by the Ministry and the National Farmers' Union, and has received the approval of the various organizations of distributors concerned. A similar scheme is already in operation for apples and pears, and the machinery devised for this has been adapted and extended to meet the particular needs of tomatoes and cucumbers.

1. Standard Grades, Packs and Packages.—Standard grades have been drawn up, approved by the industry, and defined by regulation under the above-mentioned Act. Details of these standards are given in Appendix I. Standard methods of packing and the standard packages which are required to

* Ministry of Agriculture and Fisheries, Marketing Leaflet, No. 10,

be used with these grades, when statutory grade designation marks are applied, are given in Appendices II and III respectively. These standards are experimental in the sense that they are subject to review in the light of experience.

2. The National Mark.—The Minister has, by regulation† under the Act, prescribed what has come to be known as the National Mark for use, in conjunction with a statutory grade name, as a grade designation mark on packages of home-grown tomatoes and cucumbers. The use of the National Mark is wholly voluntary. Growers and packers may apply it in addition to, or in substitution for, a private mark; but, obviously, a National Mark which may, in time, come to mean so much must, from the start, be carefully safeguarded against misuse. For this reason, and in order to give confidence to buyers, authority to apply the National Mark will only be granted to those persons and organizations who undertake to conform to certain conditions calculated to ensure efficiency and will submit to a voluntary control for that purpose. Thus, it will be necessary that the National Mark label should indicate not only the statutory grade designation of the contents of any package to which it may be applied but also the identity of the registered packer, so that complaints in regard to produce marketed under the National Mark can be followed up. When a National Mark label is applied to or used on any package, it is provided in the Act that, notwithstanding any contract or notice to the contrary, it shall be deemed to be a term of the contract of sale that the quality of the contents accords with the statutory definition of the grade designation appearing on the label. The ultimate penalty for non-observance by a packer of the conditions of the scheme will be the withdrawal of his right to apply the Mark.

National Mark Committee.—In accordance with the Agricultural Produce (Grading and Marking) (General) Regulations, 1928, a National Mark Committee has been appointed by the Minister and empowered to issue authorizations to apply the Mark and to revoke or suspend any such authorization.

Trade Committee.—A Trade Committee, consisting of growers and distributors, with an independent chairman, has been appointed by the Minister to advise the National Mark Committee in regard to the application of the Mark to fruit.

† Agricultural Produce (Grading and Marking) (Tomatoes and Cucumbers) Regulations, 1929.

Roll of Registered Packers.—Packers who are authorized by the National Mark Committee to apply the National Mark will be registered by the Committee for that purpose. Registration is open to growers, individually or in association, fruit buyers or specialist packers. In the first year, permission to apply the Mark will not be granted to growers whose total area of land under glass devoted to tomato or cucumber culture is less than $\frac{1}{4}$ acre (10,890 sq. ft.) for each fruit, or to packers who are handling less than a similar output equivalent. Separate registration is necessary for the application of the Mark on tomatoes and on cucumbers. The terms and conditions under which growers and packers with a smaller area of glass or smaller output equivalent than that specified above, will be permitted to apply the Mark, consistent with its due protection from misuse, will be considered jointly by the Ministry and the National Farmers' Union when sufficient experience has been gained of the working of the scheme.

The National Farmers' Union, through its branches in fruit-growing and glasshouse areas, has undertaken to receive applications from those who desire to participate in the scheme, but it is not necessary for an applicant to be, or to become, a member of the National Farmers' Union or of any other association to qualify for applying the National Mark. Applications so received will be passed to the Trade Committee for consideration and recommendation to the National Mark Committee. If the Trade Committee declines to recommend an applicant to the National Mark Committee, or advises that permission given to a packer to apply the National Mark shall be suspended or withdrawn, the packer concerned shall have the right to appeal to the National Mark Committee.

Inspection Service.—In a voluntary scheme of this kind, it is safe to assume that the participators have honest intentions; on this account, the inspection necessary to safeguard the reputation of the National Mark should be small compared with that required for a compulsory scheme. Moreover, distributors' organizations have signified their willingness to co-operate by reporting cases of default to the Ministry. The inspection service will be supplied, at the start, by the Ministry.

3. Conditions of Enrolment as a Registered Packer.—Registered packers will be required to comply with the following conditions :—

- (1) The National Mark may only be applied by means of the official National Mark labels, which must be paid for and kept in safe

APPENDIX I.**GRADE DESIGNATIONS AND STATUTORY DEFINITIONS FOR TOMATOES AND CUCUMBERS PRODUCED IN ENGLAND AND WALES.**

Grade Designation	Statutory Definitions			
	Weight	Blemish and Shape	Condition and Ripeness	Tolerance (applicable to lots)
(1)	(2)	(3)	(4)	(5)
<i>Tomatoes</i> A 1.	From $\frac{1}{8}$ lb. to $\frac{1}{2}$ lb.	Entirely free from blemishes including those known to prevent full red colouration on maturity; smooth skin; round.*	The fruit, at time of packing, must be sound, firm, and have reached a stage of maturity which will allow of ripening during the time normally required for distribution.	In order to allow for variations incident to proper grading and handling, not more than 3 per cent., by count, of any lot of fruit may be below the requirements specified in Columns 3 and 4.
<i>Cucumbers.</i> A 1.	From $\frac{1}{4}$ lb. to $1\frac{1}{2}$ lb.	Entirely free from blemishes; straight and regular.	The fruit must be unfertilized, firm, sound, and of uniformly fresh green colour.	

NOTE.— * “Round” means that the circumference of any section taken at right angles to a line running from stem to eye is approximately circular.

APPENDIX II.
STANDARD METHODS OF PACKING TO BE EMPLOYED WHEN GRADE DESIGNATION MARKS ARE APPLIED.*
Tomatoes.

Grade Designation	Package	Particulars to be declared		Lining paper and packing material	Colour	Tolerance (applicable to lots)
		Weight range (Fruits to 1 lb. : Maximum and minimum)	Minimum net weight of contents			
A 1.	Tomato box No. 12 chip No. 3 veneer Strike (returnable)	5-8 (P.)† 8-12 (P.W.) 11-14 (P.W.X.) 13-16 (W.)	12 lb.	Packages to be fully lined with pink and/or white papers, as follows :— 5-8 (P.) pink. 8-12 (P.W.) } pink 11-14 (P.W.X.) } 13-16 (W.) white. Tomato box and half-tomato box to be lined with a corrugated sheet on the face. Wood - wool and/or additional sheets of corrugated paper must be used to complete the filling of the box. Strikes must have an additional outer lining of stout paper or corrugated liner.	The colour of all fruits throughout the package must be uniform	In order to allow for variations incident to proper packing and handling, not more than 5 per cent., by count, of any lot of fruit may fail to conform to the weight range specified.
	Half tomato box No. 6 chip No. 4 veneer 6 lb. wicker handle basket (returnable)	5-8 (P.)† 8-12 (P.W.) 11-14 (P.W.X.) 13-16 (W.)	6 lb.			

* See also Appendix III.

† These letters, which formerly indicated weight ranges, may be used in addition to the figures shown.

APPENDIX II.—Continued.
Cucumbers.

Grade Designation	Package	Pack	Count (to be declared)	Weight range (The variation in the weight of individual cucumbers in any one package may not exceed)	Minimum net weight of contents	Lining paper and packing material	Colour	Tolerance (applicable to lots)
A 1.	{ Wicker flat basket	4 layers	30	{ 3 oz.	36 lb.	Soft, sweet, dry hay or soft wood-wool must be used for packing. Packing material must be placed on bottom and top of package and between the layers of fruits, but paper must be in contact with the fruits.	The colour of all fruits throughout the pack-age must be uniform.	In order to allow for variations incident to proper packing and handling, not more than 5 per cent., by count, of any lot of fruit may fail to conform to the weight range specified.
			36					
			42					
			48					
			60					
	{ Cucumber box	2 layers	15	{ 3 oz.	18 lb.			
			18					
			21					
			24					
			30					
	{ Cucumber tray	1 layer	8	{ 2 oz.	7 lb.			
			9					
			10					
			12					
			14					
			15					

custody, all precautions being taken to prevent their application by unauthorized persons.

- (2) When a National Mark label is applied, it must be completed in the following particulars :—
 - (a) net weight and weight range or count of contents at time of packing, as laid down in Appendix II, and
 - (b) the name, registered number or registered mark of the grower or packer.
- (3) The quality of the contents of each package to which a National Mark label is applied must conform to the statutory definition set out in Appendix I according to the fruit.
- (4) The method of packing the contents of each package to which a National Mark label is applied must conform to the details specified in Appendix II according to the fruit.
- (5) Except with the approval of the National Mark Committee, the package to which a National Mark label is applied must be one of those indicated in Appendix II, according to the fruit, and must conform to the dimensions and capacity specified in Appendix III.
- (6) A registered packer must allow his packing premises and all equipment and records to be inspected at any reasonable time by any officer of the Ministry of Agriculture and Fisheries authorized in that behalf, and must allow any such officer to open and inspect at any time and place, packages packed by such registered packer and bearing a National Mark label.

4. Supply of Official National Mark Labels.—Official labels bearing the National Mark and grade will be issued, on payment, to registered packers by or on behalf of the Ministry in sizes to fit the standard packages. They may not be obtained from any unauthorized source and they are not transferable.

Growers and others who desire to avail themselves of the advantages likely to accrue from the application of the National Mark to tomatoes and cucumbers and who are able to fulfil the conditions set out in this leaflet, should apply at once for an enrolment form to the Secretary of the nearest local branch of the National Farmers' Union or to the Headquarters of the Union, 45 Bedford Square, London, W.C. 1.

APPENDIX III.

The following standard packages are to be employed when grade designation marks are applied to Tomatoes and Cucumbers :—

PACKAGES

(All dimensions are internal)

NON-RETURNS

Wood Boxes

Tomato Box : (12 lb.)— $14'' \times 9'' \times 5\frac{1}{2}''$ —Contents 693 c. in.

Specification : Ends, 2 pieces $9'' \times 5\frac{1}{2}'' \times \frac{3}{4}''$; Sides, 2 pieces $14\frac{1}{2}'' \times 5\frac{1}{2}'' \times \frac{3}{4}''$; Bottom, 2 pieces $14\frac{1}{2}'' \times 4\frac{1}{2}'' \times \frac{3}{4}''$; Top, 3 pieces $14\frac{1}{2}'' \times 2\frac{1}{2}'' \times \frac{3}{4}''$; Cleats, 2 pieces $9'' \times 1'' \times \frac{3}{4}''$.

Half Tomato Box : (6 lb.)— $11'' \times 7'' \times 4\frac{1}{2}''$ —Contents 365.75 c. in.

Specification : Ends, 2 pieces $7'' \times 4\frac{1}{2}'' \times \frac{3}{8}''$; Sides 2 pieces $11\frac{1}{2}'' \times 4\frac{1}{2}'' \times \frac{3}{8}''$; Bottom, 2 pieces $11\frac{1}{2}'' \times 3\frac{1}{2}'' \times \frac{3}{8}''$; Top, 3 pieces $11\frac{1}{2}'' \times 2'' \times \frac{3}{8}''$; Cleats, 2 pieces $7'' \times \frac{1}{2}'' \times \frac{3}{8}''$.

Cucumber Box : $20\frac{1}{8}'' \times 14\frac{1}{2}'' \times 4\frac{1}{2}''$ —Contents 1,345.8 c. in.

Specification : Ends, 2 pieces $14\frac{1}{2}'' \times 4\frac{1}{2}'' \times \frac{7}{16}''$; Sides, 2 pieces $21\frac{1}{2}'' \times 4\frac{1}{2}'' \times \frac{1}{4}''$; Top and bottom $21\frac{1}{2}'' \times 13\frac{1}{2}'' \times \frac{1}{8}''$ in 3 pieces each; Cleats, 4 pieces $14\frac{1}{2}'' \times 1'' \times \frac{7}{16}''$.

Single Layer Tray : $22\frac{1}{8}'' \times 17'' \times 3''$ —Contents 1,129 c. in.

Specification : Ends, 2 pieces $17'' \times 3'' \times \frac{7}{16}''$; Sides 2 pieces $23'' \times 3'' \times \frac{1}{4}''$; Top and bottom $23'' \times 5\frac{1}{8}'' \times \frac{3}{16}''$ in 3 pieces each spaced $\frac{1}{2}''$ apart. Cleats, 2 pieces $17'' \times 1\frac{1}{2}'' \times \frac{7}{16}''$.

Cement-coated nails only to be used in nailing up boxes and trays. The correct sizes for use with wood packages specified in this schedule are $1\frac{1}{2}$ in. 16s. gauge for cucumber box and tray and $1\frac{1}{4}$ in. 16s. gauge for tomato boxes.

Chip Baskets (with handles)

Name	Bottom	Top	Side	Standard Capacity (Minimum)
No. 12 taper ..	$13\frac{3}{4}'' \times 7''$	$15\frac{1}{4}'' \times 8\frac{1}{4}''$	$6''$	670 c. in.
„ 6 „ ..	$11'' \times 6\frac{1}{8}''$	$13'' \times 7\frac{5}{8}''$	$4\frac{1}{2}''$	370 c. in.

Bottom and side measurements taken from scoring; top measurements are average widths and lengths inside binder.

Veneer Boxes

Size	Hitherto known as	Internal dimensions	Contents
No. 3	12 lb.	$13'' \times 8\frac{1}{4}'' \times 6\frac{1}{4}''$	670.3 c. in.
„ 4	6 lb.	$10\frac{1}{2}'' \times 7\frac{3}{8}'' \times 4\frac{3}{4}''$	367.5 c. in.

RETURNABLES

Wicker Baskets

Strike.—Diameter, $11\frac{1}{4}''$; Depth at side, $6\frac{3}{4}''$; Depth at middle, $5\frac{1}{4}''$. Contents, 763 c. in.; Variation + 30 c. in.

Flat.—Length, $21''$; Width, $15''$; Depth, $8''$. Contents, 2,520 c. in.; Variation + 100 c. in.

6 lb. Handle.—Top, $13'' \times 7''$; Bottom, $8\frac{1}{4}'' \times 5''$; Depth, $5\frac{1}{4}''$. Contents, 370 c. in. approx.

Boxes

Single Layer Tray.—Length, $22''$; Width, $16''$; Depth, $2''$ (approx.)

* * * * * *

BLACK CURRANT CULTURE FROM SUMMER CUTTINGS

H. GOUDE, N.D.H.,

Horticultural Superintendent for Norfolk.

FURTHER experience in the summer propagation of black currant bushes from green cuttings* has confirmed the earlier trials. By this method of propagation a cultivator is able to build up a stock of any variety entirely free from the bud gall mite, *Eriophyes ribis* Nalepa, and consequently from "reversion" also. It has been found that by selecting the cuttings about the end of May or early June, the heaviest fruiting bushes are readily recognized as they are carrying the season's fruit, and by selecting to a special type of growth and fruiting character, an improved strain of the variety is secured in one season.

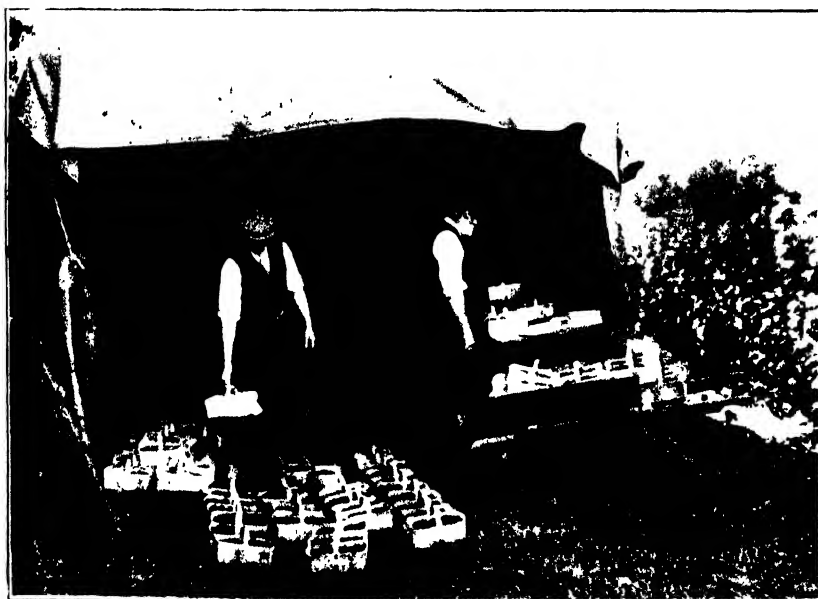
The Marlingford Trials.—The most complete trial of the system has been carried out by Major E. H. Evans Lombe on his Home Farm at Marlingford, eight miles from Norwich. The original intention was to demonstrate black currant culture in a new district. The soil is an average good, mixed loam, with pockets of stiff clay and patches of lighter soil. On the latter, the bushes have always made the most satisfactory growth, while on the clay pockets the growth is poorer, and on one bad patch of this character, the bushes have been very poor in growth and unprofitable. The soil is not ideal for black currant culture, but the slight slope of the site to the south-west is a valuable factor. There was no skilled labour on the farm in a fruit-growing sense. The farm steward, Mr. Norton, then nearly 70 years of age, had not had previous experience in black currant culture, but he entered into the project with great enthusiasm, and the success of the plantation is chiefly due to his management and cultural skill.

Planting.—The first acre was planted in 1921 with purchased yearling plants from two growers. The variety is of the French type from a very old Norfolk stock. Only 500 bushes could be obtained from each of the two growers to whom cuttings of the stock had been given for propagation a year or two earlier. The bushes from one grower have always cropped better than the bushes from the other, a fact attributable to more skilful selection of cuttings for propagation, and better attention to the growing plants.

* See this JOURNAL, August, 1921, p. 460.



View of plantation during the picking of the fruit, 1928



A temporary packing shed

BLACK CURRANT CULTURE AT MARLINGFORD.

To face page 106.



Bush of French Black Cropping, 1928.

BLACK CURRANT CULTURE AT MARLINGFORD.



Bush of Babbwin Cropping, 1928.

The soil preparation throughout, for the whole planting, has been to sub-soil the land and manure with yard manure. The first acre was left until the first fruiting, *i.e.*, the second year from planting, to see if the land would grow black currants satisfactorily. As the fruiting was exceptionally good, preparations were made in May for striking soft cuttings from the best bushes for planting a second acre the following winter. This has been the procedure each summer, when further plants were required for extension of the plantation. A double-lighted frame will hold about 500 cuttings. Two of these are filled for planting one acre, giving 1,000 plants. The plants from this method are single stems about 18 inches in height, and lift out of the frames with good balls of earth ready for planting direct into the field in October or as soon after October as possible.

Distances of Planting.—The plants on the first acre were planted at distances of 6 ft. by 6 ft. The bushes were cut down, and the severed shoots made into cuttings, and inserted between each bush in the rows, north and south. This left 3 ft. from plant to plant in the rows, and 6 ft. between the rows. These distances were found to be too close for horse work. When planting the second acre the distance was increased to 7 ft. between the rows, and 3½ ft. from bush to bush. This space between the rows also proved insufficient for horse cultivation and spraying. In subsequent planting the distances have been 8 ft. by 4 ft.—8 ft. between the rows, and 4 ft. from bush to bush in the rows. The wider distances have facilitated cultivation, and the crop production per bush appears to have been increased. The weight of fruit has not been recorded with scientific exactitude, but the observation is made on the yield of fruit per section during the picking season. It is known that the fruit comes into the shed quicker from the 8 ft. by 4 ft. plant, which indicates the heaviest cropping bushes. Probably the distance between the rows can still be increased with the advantage of further reducing cost of production, as land value is a low charge in production costs.

In the year after planting, one row of mangolds has been grown between the rows of bushes. No harm is done by this inter-cropping providing the inter-crop is not allowed to compete with the bushes, and that it is removed without injury to the bushes or land. The inter-crop is advantageous in reducing the cost of establishing the plantation. The roots grown on the black currant land are of exceptionally fine

quality, and were shown in the Norwich Root Shows each autumn. In 1925, Major Evans Lombe gained seven first and two second prizes with these roots, and similar successes in other seasons. The plantation was also entered for the Royal Agricultural Society's Orchard and Fruit Plantation Competition, and was awarded first prize in its section.

Crop Weight and Returns.—Table I gives a summary of the costs, receipts and profits of the plantation for the five years, 1924-28, and Table II the detailed account for the latest year, 1928, as typical of the annual accounts from which the figures in Table I have been taken. The accounts have been audited by Mr. Bassett Horner, of Norwich.

Appreciation and depreciation of the plantation has not been considered. The only capital expenditure incurred was £11 for the first 1,000 bushes. If it were necessary to remove the bushes from the land, the cost would be approximately £2 per acre for pulling up and burning the bushes, and the land would then be more productive than at any time in its history, as black currant culture improves the soil.

TABLE I.—MARLINGFORD PLANTATION: COSTS AND RECEIPTS, 1924-28.

Year	Area	Costs			Receipts			Profit		
		£	s.	d.	£	s.	d.	£	s.	d.
1924	.. 1 acre picked	47	13	11	159	1	9	111	7	10
1925	.. 2½ acres ..	107	0	1	278	0	9	171	0	8
1926	.. 3 „ „	157	0	6	525	4	2	368	3	8
1927	.. 4 „ „	176	6	2	336	3	0	159	16	10
1928	.. 5 „ „	276	10	10	589	13	4	313	2	6

The above figures are not given as representing the average cost of production per acre for Norfolk, but as showing the actual cost on this particular demonstration. The heaviest item of expenditure in each year is for picking the fruit.

The establishment cost for Marlingford per acre is very low. As already stated, the 1,000 bushes for planting the first acre cost £11. The cost of striking 1,000 summer cuttings and care to October is about £2, including the rent of the lights and frames. There is then the cost of planting—£1 10s. per acre. On this system the total cost of the home-raised plants and planting will average out at the strikingly low figure of £3 10s. per acre. Add to this the cost of soil preparation and manuring, the cost of hoeing and spraying for the season, and the rent, etc., of the land, and we have the cost of maintenance of the plantation up to the end of the first year.

At Marlingford, 1,000 plants are allowed to one acre of land. The best of the plants are set 8 ft. by 8 ft. over the land. The top of each bush is then cut off and inserted as a cutting between each bush in the rows, eventually leaving a plant of 8 ft. by 4 ft.

TABLE II.

MARLINGFORD HALL FARM : BLACK CURRANTS, SEASON 1927-28

NET RECEIPTS			(Area picked 5 acres)		PAYMENTS	
	T. Cwt.	Qr. Lb.	£	s. d.		£ s. d.
Black Currants sold:						
Manchester Market	..	6 18 3	24 379	6 3	Labour for cultivating black currants	.. 59 17 6
Norwich	..	1 16 3	21 69	7 6	Horse labour	.. 8 2 6
Glasgow	..	17 2 12	54 7	1	40 loads manure at 5s.	.. 10 0 0
Local buyer	..	19 1 4	38 8	4	Rent and rates	.. 12 10 0
Sundry lots currants sold	..	2 1 0	8 10	0	Gathering black currants as per book	.. 95 4 3½
Local buyer	..	14 1 14	35 17	6	Railway charges	.. 49 6 5
					Rubber bands	.. 0 18 0
	11 9 1	19			Carriage on chips	.. 0 8 9
Railway charges refunded	..	..	3 16	8	Tar oil winter wash	.. 3 0 0
					Teas for pickers	.. 2 19 4½
					Telegrams and stamps	.. 0 7 6
					Chip baskets	.. 29 14 0
					Basic slag	.. 4 2 6
					Balance, being net profit	.. 313 2 6
			£589 13	4		£589 13 4

Note.—The accompanying photographs were taken in July, 1928, and are a fair illustration of the character of the cropping throughout the plantation. The main variety is French Black. A few Baldwins, Boskops and September Black are included for trial.

BACTERIAL CONTENT AND THE KEEPING QUALITY OF MILK

H. BARKWORTH, L. J. MEANWELL, and M. G. D. TAYLOR,
In conjunction with the National Institute for Research in Dairying.

IN February, 1927, a paper was published in this JOURNAL concerning the relationship between the bacterial content and the keeping quality of milk. That paper was based upon figures which had been obtained from 10 competitions held during the years 1923-25, and covered the examination of 2,476 samples.

Since that date, statistics have been obtained from eight further competitions which were held in Berkshire (1926-27), Hants (1926-27), Middlesex (1927), Oxfordshire (1927), Northants (1927) and Dorset (1927), with a total of 2,400 samples. The results of these further competitions have been combined with the original results, and the figures obtained are shown in Tables I and II.

TABLE I.

COUNT	<i>B. coli</i> not found in 1 c.c.			<i>B. coli</i> present in any dilution up to 1/1,000 c.c.		
	Samples	Total hours sweet	Average hours sweet	Samples	Total hours sweet	Average hours sweet
0- 1,000 ..	560	43,119	77	60	4,293	71
1001- 5,000 ..	670	48,327	72	223	14,901	66
5001- 10,000 ..	297	20,940	70	191	12,136	63
10,001- 30,000 ..	268	18,585	69	356	21,555	60
30,001- 50,000 ..	85	5,172	60	173	9,964	57
50,001-100,000 ..	89	5,487	61	227	12,054	53
100,001-200,000 ..	62	3,609	58	208	11,076	53
200,001-500,000 ..	64	3,702	57	319	15,669	49
500,001-750,000 ..	19	1,161	61	105	5,142	49
Over 750,000 ..	53	2,982	56	847	34,851	41
TOTAL ..	2,167	153,084		2,709	141,641	

There is little doubt that, since the first paper was published, the methods of carrying out laboratory work have been improved and there is less liability to variation than was the case in the early days. Thus, all laboratories are now provided with an incubator at a constant temperature of 60° F., and the majority of samples are examined at ages that vary from 24-29 hours, but it is still true that some samples are not cooled before their dispatch from the farm, and there is no control over the temperatures at which they are kept during

transit. Nevertheless, the figures obtained bring out the relationship that exists between bacterial content and keeping quality, and, although the averages which are inserted in the tables cannot be taken as in any sense final, they do indicate the type of relationship that may be anticipated when a sufficient number of statistical facts have been collected.

Consideration of Tables I and II.—Table I is divided into two parts. On the one side are shown the numbers of samples, of which the bacterial counts fell within certain limits and in which *B. coli* was not found; on the other the samples of similar counts, but in which *B. coli* was found to be present in any dilution up to 1/1,000 c.c.

If Table I be studied, it will be seen that there is a steady fall in the period of sweetness of the milk as the bacterial count increases; thus, milk with a count of 0-1,000 and no *B. coli* had an average keeping quality of 77 hours, whereas the samples which contained more than 50,000 colonies did not show an average sweetness of more than about 60 hours.

The table further shows that the presence of coliform organisms has a markedly deleterious effect on the keeping properties of the milk, thus milk with a count of 1,001-5,000 and an absence of *B. coli* in 1 c.c. had an average keeping quality of 72 hours, whereas milk of the same count with coliform organisms present in any dilution up to 1/1,000 c.c. had an average keeping quality of 66 hours. This depression in keeping quality due to the presence of coliform organisms remains true in every case.

The observation made in the previous paper that "it appears to be possible that within limits a higher bacterial count with the absence of *B. coli* has a less deleterious effect on the keeping quality of milk than a lower count when these organisms are also present" is confirmed by the addition of the fresh figures to the original table. Thus, the samples which gave counts of 30,000 or less and no *B. coli* had a longer average keeping quality than those which gave counts of 1,001-5,000 but contained *B. coli*.

The additional figures which have been embodied confirm the statements made in the previous paper that a study of keeping quality, based on the result of bacterial count alone, leads to fallacious and unjust results. Thus, while a man who supplies milk with a bacterial content of not more than 30,000 per 1 c.c. and no coliform organisms is doing very useful work, which is reflected in an average keeping quality

TABLE II.

COUNT	Coliform organisms present in 1 c.c. but not in higher dilutions			Coliform organisms present in 1/10 c.c. but not in higher dilutions			Coliform organisms present in 1/100 c.c. but not in higher dilutions			Coliform organisms present in 1/1,000 c.c. Higher dilutions not tested		
	Samples	Total hours sweet	Average hours sweet	Samples	Total hours sweet	Average hours sweet	Samples	Total hours sweet	Average hours sweet	Samples	Total hours sweet	Average hours sweet
0- 1,000	37	2,760	74	20	1,371	68	2	114	57	1	48	48
1001- 5,000	131	9,054	69	61	3,825	62	27	1,770	65	4	252	63
5001- 10,000	86	5,704	66	63	4,038	64	37	2,136	57	5	258	51
10,001- 30,000	148	9,321	63	109	6,486	59	66	3,966	60	33	1,782	54
30,001- 50,000	46	2,776	60	61	3,558	58	40	2,262	56	26	1,368	52
50,001- 100,000	58	3,063	52	75	3,951	52	48	2,598	54	46	2,442	53
100,001- 200,000	32	1,728	54	55	2,952	53	52	2,808	54	69	3,588	52
200,001- 500,000	36	1,752	48	46	2,403	52	70	3,513	50	167	8,001	48
500,001- 750,000	12	630	52	14	690	49	20	1,068	53	59	2,754	46
Over 750,000	13	624	48	40	1,836	46	73	3,420	46	721	28,971	40
TOTALS	599	37,412		544	31,110		435	23,655		1,131	49,464	

of 69 hours, this period is reduced by 9 hours in the case of those whose work is less efficient in view of the fact that their milk, having the same count, contains coliform organisms.

If, however, the results be combined, as would be the case if the results were based upon count alone, an average keeping quality of 64 hours is found to be attained. The better work is thus penalized to the extent of five hours, and work of a lower standard gains an undeserved addition of four hours to the average keeping quality of the milk produced. Too much stress cannot be laid upon the extreme importance of such a difference if the whole milk trade is to be carried on successfully.

Table II indicates quite clearly that the presence of coliform organisms in 1 c.c. has a definite effect on the keeping quality; thus, a count of 0-1,000 with the presence of *B. coli* in 1 c.c. results in a loss of three hours in keeping quality. Similar results are found to obtain when *B. coli* are present in the higher dilutions.

As further statistics become available, it will be possible not only to arrive at the general average but also other sets of figures of importance to the industry—*e.g.*, the relationship between bacterial count and temperature, and the liability to error above and below the average. From these figures it is hoped that it will become possible to inform the dairyman that if he receives a milk of a certain bacterial count at a certain temperature he may anticipate that the milk will maintain a known average period of sweetness, and the number of occasions on which the milk will fall above or below this standard. These facts will put him in an extremely strong position in the conduct of his business.

* * * * *

CLEAN MILK : A PRIZE ESSAY

F. H. BEAVIS, M.S.I.A.

Chief Sanitary Inspector, Borough of Swindon.

[At a Clean Milk Course for Sanitary Inspectors, held last November at Trowbridge, under the auspices of the Agricultural Advisory Department of the University of Bristol, it was suggested and arranged that each of the Inspectors attending should write a popular essay on the subject of Clean Milk. The essay awarded first place by three judges was to receive a prize and be published in the local Press for propaganda purposes. The judges (Messrs. A. W. Ling, C. A. MacEachern and F. C. White) were unanimous in awarding the prize to the essay which appears below. All the essays submitted were of a high standard, and there would have been considerable difficulty in making the award but for the fact that some of the papers sent in took the form of a technical treatise on milk rather than the popular article that was desired.]

IN recent years a great deal has been heard about a clean milk supply. Everyone is agreed that clean milk is very desirable, but to obtain such an article it is necessary to convince the producer that clean milk is a business proposition. In other words, the producer expects to be paid for the extra trouble he has taken to supply the article demanded, otherwise he will no doubt prefer to carry on in the same old way. There are, however, other ways of looking at the question, apart from the possibility or otherwise of obtaining an extra 1d. or 2d. per gallon for the milk produced, and in this paper I am going to try and show what these other ways are.

Clean milk must be taken to mean natural, raw milk from a healthy cow, as nearly as possible in the same condition as obtained, produced in such a way as to avoid all risk of contamination—pure, sweet and wholesome. To produce such a milk as this the farmer has to take precautions, but such precautions need not be expensive, and, once a suitable system has been evolved, the workers soon get accustomed to it and very little extra time is taken up. The gain to the public and the farmer, however, is enormous : to the public, because such milk is absolutely clean, and therefore safe as a food ; to the farmer, because the losses caused by milk souring would be reduced to a minimum, and the increased

demand would enable him to keep more cows, to sell his milk in the best market, to use his labour to greater advantage and to give more satisfaction to both wholesale and retail customers.

To produce clean milk, a few essentials are necessary, and are as follows : a strong, healthy herd of cows ; interested labour ; suitable equipment in the shape of covered or close-topped milk pails ; a good cooler ; some means of sterilization for the utensils. The buildings may be modern and ideal, or they may be old and somewhat unsuitable, in which case they can be greatly improved by the provision of an impervious floor, efficient drainage, adequate light and ventilation, and scrupulous cleanliness. This may appear to be rather a tall order, but in practice it is very often found that old buildings are easily and inexpensively adapted for the purpose. Dirt and warmth are the worst enemies of the clean-milk producer ; the milk, therefore, should be thoroughly cooled as quickly as possible after being obtained. Dirt, in any shape or form, should be especially avoided. This can be accomplished by clean methods in milking. The cows should be brushed down so as to remove all manure and dust from their coats. The udders should be washed and then wiped with a clean cloth. All long hairs around the udder and teats should be clipped off and the tuft on the tail trimmed up. Milkers' hands must be thoroughly washed, and clean overalls should be worn during milking. Fore milk should be discarded owing to the risk of bacteria having invaded the milk ducts of the teats. In this way, the bacterial count is considerably lowered and the keeping quality of the milk is greatly enhanced.

Having by these methods obtained a milk with a low bacterial count, the next proceeding is to cool it thoroughly. Bacteria quickly multiply if the conditions are favourable. The warmth of the milk favours their growth, but cooling tends to retard this—hence the importance of efficient cooling.

We will now direct our attention to the dairy or milk room. This should be light and airy, scrupulously clean, and with an impervious floor. The walls should be constructed of suitable material so that they can be easily washed down to remove all milk splashings. Plenty of hot and cold water should be available and all utensils must be thoroughly washed before being put in the sterilizer. All straining or other cloths should be boiled, otherwise they are likely to cause contamination of the milk. The better way is to use cotton wool pads for straining ; these being used once only, the

danger of adding bacteria to the milk is avoided. Lastly, the milk should be sent out in sealed churns of the mushroom lid type, as these reduce the danger of contamination in transit to a minimum.

One of the great factors in the production of clean milk is to get the men interested. This is readily done if a sediment tester is used, as it enables each man to see the result of his own work, and the spirit of competition is introduced, because each man is anxious to have the least possible sediment in his sample.

Finally, I would advise all would-be producers of clean milk to call in their local sanitary inspector. It is a great mistake to look upon this officer as an enemy. He is anything but that. He is usually an enthusiast, and his sole ambition is to help the producer in every possible way, by giving advice and by a little friendly criticism. He is usually quite reasonable, and many valuable hints may be obtained by consulting him. For practical and technical advice, the services of the agricultural organizer to the County Council are at the disposal of all farmers and milk producers whose premises are within the county. This officer is always willing and anxious to give advice and render any assistance which may be required.

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MAY ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),
Agricultural Organizer for Derbyshire.

Seasonal Notes.—The May Day of mediæval times was 12 days later than that of to-day. This difference is sufficient to account for the paucity of blossoms or other evidences of summer which are proverbially associated with this month. The name May is derived from the Latin Maia, the goddess of growth and increase, and our former custom of celebrating the arrival of this season doubtless had its origin in the corresponding Roman festival in honour of the goddess Flora. A relic of our custom of gathering knots of flowers on May-day survives in the well-known children's game, though the word "nuts" has displaced the proper term "knots."

May is not really a summer month: the nights are frequently chilly and in some districts ground frosts are a common feature of the early morning. Cold east winds too often prevail in this month, checking the growth of grass and bringing to mind the old saw—"Be sure of hay till the end of May." Indeed a cold May is traditionally regarded as favourable to agriculture; but with the increased importance of grassland and fodder crops in modern husbandry, conditions that suited a former system of farming are not so welcome to-day. Light hay crops, thin and weedy roots, and bare pastures are the consequences of such May weather as pleased the husbandman of the seventeenth century.

Turning Out Time.—This year, the transition from winter to summer management of live stock will by necessity have been made gradually. Supplies of winter forage began to run short long before the customary grass day drew near, and cattle were given early access to grasslands to gather such supplementary keep as they could find. The arguments against such early grazing of the pastures do not now apply with quite such force as they did a few years ago, when the use of nitrogenous stimulants to secure a re-growth was not part of our farming technique.

Formerly fields that had been eaten down in April and early May could afterwards be readily found by their prolonged bare condition and the abundance of daisy flowers in their sward. Under progressive management, however, these effects are largely obliterated by the rapid recovery of the grass, provided that sufficient moisture is present. This year the first three months—January, February and March—

have all been exceptionally dry, and April, so far, has had little rain. There is, therefore, little reserve of moisture in the soil, and much depends on the occurrence of ample rain during the second half of April and the early part of May.

Cattle Rearing.—The rise in the price of store cattle about the middle of April, when grazing prospects as regards keep were not attractive, is probably an indication of a scarcity in young stock as well as a result of a growing belief in the likelihood of a material rise in beef prices. It will be remembered that the Ministry's statistics of June, 1927, revealed a fall of 31,321 in the number of cattle under one year; and again in 1928 the figures showed a further drop in this class of cattle, *viz.* by 78,267: in all, the numbers of cattle fell by nearly 250,000 between June, 1927, and June, 1928. During the year 1928, importations from Ireland increased by 141,521 compared with the previous year; but during the same year the acreage of permanent grass increased by 116,264 acres.

It may be argued that the cattle statistics merely prove that many farmers have regarded cattle rearing as less remunerative than milk production at the prices which have prevailed in recent years, and that by the law of supply and demand the two branches of the cattle industry will gradually readjust themselves. The problem is complicated, however, by the needs of the grazier who requires stores for fattening.

Taking the figures as a whole they cause one to wonder why store cattle have continued for so long at prices only 21 to 23 per cent. above pre-war level, while fat cattle and dairy cows have had a price index at least 10 points higher. A rise in the value of stores was apparently overdue, and if the above review of the situation is correct, rearing will be more remunerative than it has been of late.

The disappointments suffered by dairy farmers whose home-bred heifers milk badly were discussed in the March notes. Greater care in the selection of the dairy bull—including inspection of his parents for conformation and of the milking records of his dam and grand-dams—will help to solve that problem. There are, however, many farmers whose holdings are better adapted for milking purchased cattle than for the maintenance of a milking herd by breeding. Such farmers contend that their system is being copied by too many of those who formerly bred stores and heifers for sale, with consequent excess production of milk. There is no doubt that the milking situation would be relieved if a

sufficient number of farmers turned their attention to cattle rearing instead of milk production, but this will come about only as a result of improved prices for stores. An experienced and competent observer recently remarked to me that few farmers failed who make cattle rearing a regular feature of their system ; but one could not help thinking that in recent years few farmers can have made substantial profits out of cattle rearing alone.

Preparing for Mowing.—May is too early in most districts for any indication of the prospects of the hay harvest. It is not too early, however, for giving a thought to the hay-making equipment. There will, doubtless, be a number of rainy days when men and teams cannot be employed in the working of land intended for swedes, kale and sugar beet, or in giving the early side-hoeings to the mangolds. Such days may well be utilized in overhauling the mower and other machines likely to be needed in June. Too often the necessary repairs are not remembered until near the time for commencing to mow.

The new mower always goes well, no matter what make it is. It cuts clean over the entire width of the swath ; the fingers leave little rib or track in the grass ; and the cut herbage readily falls from the finger bar, having no inclination to hang on to the front of the blade. Moreover, the draught is light ; the machine appears to be well balanced in every way ; and it makes little noise. Further, the blade will run a long time without re-sharpening. With such a machine there is some inducement to be up before sunrise and cut three or four acres before milking.

The virtues of the new machine last about as long as the coat of varnished paint that adorns it. After a few years' wear, it becomes less efficient ; the draught becomes heavier than it once was ; and in various other ways the machine, while to external appearances in quite good condition, is far less satisfactory than it was when brand-new. When something visibly broken or defective is observed, the machine is sent to be repaired ; but in spite of this repair it is still not in good order. After a little more trouble the mower is scrapped, or put into some farm sale and is bought by someone who judges its value by its apparent age.

Many mowers are annually scrapped that could, with a little intelligent overhauling and not very great expense, be made practically as good as new. The knowledge of how to overhaul a mower is, however, of the greatest value when

used to avert the need for repairs. There are a number of adjustments and attentions which a mowing machine should receive if it is to continue to work well; and if these are neglected, the additional stress thrown on other parts of the mechanism (as well as on the horses) brings on other troubles.

The principal parts of the machine are the cutter-bar and the blade. The common impression is that the sections of the blade do all the cutting; consequently all the attention given to the work of sharpening is concentrated in whetting the edges of the blade sections. The blade-edge, however, is only one side of the pair of shears that cut the grass; the other side is the edge of the plate on which the section slides. If the latter is dull or rounded by wear or rusting, the edge of the ledger plate fails to perform its part of the work and the grass is torn rather than cut across. The edges of the ledger-plate should therefore be sharpened up from time to time, and protected from rust when not at work.

Sharpness is not, however, the only requirement in this connexion. The section must actually slide upon the ledger plate of the finger. All the finger plates should also be in proper line or level, so that every section of the blade bears evenly on the two plates over which it slides. When a new finger is being inserted into an old finger bar, care should be taken to reduce its level to that of the worn plates.

After levelling the plates (and, if necessary, straightening the blade) the caps or clips that hold the blade down may be adjusted. The proper clearance between the blade and the caps is that of the thickness of a piece of writing paper.

Among other adjustments may be mentioned that of the connecting rod—to make the sections “centre” correctly. The blade should move so that each section travels from the middle of one finger to the middle of the next. If the sections are not in the middle of the fingers when the connecting rod is at either end of its stroke, the machine cannot do good work and its draught will be severe. This defect is nearly always found in a machine whose finger bar is out of alignment; and the connecting rod is then thought to be too short. It is necessary, therefore, first to align the finger bar by adjustment, where adjustment is provided, or if necessary by fitting new hinge-pins. Next the length of the connecting rod may be adjusted. In some machines this is a simple matter of screwing the head to lengthen or shorten the rod as may be necessary; in others the rod has to be heated and either drawn out or jumped.

NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,

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Continuous Mangolds.—It is not unusual for farmers to grow mangolds year after year on a small field near home in view of the heavy cartage of dung and roots. On Barn Field, at Rothamsted, mangolds have been grown on this system for 50 seasons under some 36 different manurial treatments, so that a few of the conclusions from those experiments may be of interest.

The soil is a stiff clay loam, full of flint stones resting on a clay sub-soil. Part of the area has received 14 tons of farm-yard manure for every crop. The benefit of this dunging shows most in a dry season, when, owing to the better water retaining power of a soil rich in organic matter, the plant is earlier to start and much earlier to the hoe than on the neighbouring land where only artificials are used. Even with this generous supply of dung the average crop of mangolds over the 50 seasons has not been large. Dung has yielded 18 tons of roots per acre, which is slightly less than the English average crop under ordinary farming conditions. The most effective manure in presence of this liberal dunging is nitrate of soda, even such a heavy application as 5 cwt. per acre, given in two top dressings, having increased the crop to 26 tons, *i.e.*, an increase of 32 cwt. of roots for every 1 cwt. of nitrate used. It is interesting to observe that even this large dose of nitrate has not caused the soil to work markedly worse than on plots having other forms of artificials. It is known, however, that on certain types of heavy land such damage to texture does occur.

Sulphate of ammonia (3½ cwt.) providing equal nitrogen to the above has not been quite as effective per unit of nitrogen, the increase per cwt. of sulphate of ammonia being 22 cwt. Rape cake has proved a successful source of the extra nitrogen required by mangolds, but its price is too great to allow it to compete with mineral nitrogen for this purpose, even having regard to the fact that a slight improvement in texture follows its continued use.

In presence of rich dunging and a good nitrogen supply on this heavy land phosphate and potash produce comparatively little improvement. A generous yearly mineral dressing only gives an increase of 12 cwt. of roots where nitrate of soda is used, and 48 cwt. where sulphate of ammonia or rape cake is given.

Coming now to the effect of artificials in the continued absence of dung, it is noteworthy that tolerable crops can be grown on this system provided that "complete" dressings containing nitrogen, phosphoric acid and potash are used. In the case of mangolds, compounds of soda and magnesia, that is to say the impurities in low-grade potash salts, appear to be beneficial. Complete artificials comprising $3\frac{1}{2}$ cwt. superphosphate, 5 cwt. nitrate of soda and 9 cwt. of salts of potash, soda and magnesia roughly corresponding to a high-grade kainit, have yielded on the average 18 tons of mangolds per acre. The substitution of sulphate of ammonia for nitrate of soda has again resulted in a loss of crop of about 3 tons per acre.

We may conclude, then, that mangolds can be grown quite successfully as a continuous crop. Dung alone is hardly enough for heavy yields, even when used year after year, whereas artificials alone, although satisfactory in moist seasons, may fail in times of drought. It is doubtful whether on heavy land dunging every year is necessary or desirable. Every other year should suffice, the mangolds being grown with a generous dressing of artificials in the year when no dung is applied, and a lighter dressing (mainly nitrogenous) being used in conjunction with the farmyard manure.

Town Refuse.—Farmers are always on the look-out for organic manures. Most of them have to be content with what farmyard dung is available, but those who are in the neighbourhood of towns can frequently obtain town refuse at reasonable prices. This material is, of course, exceedingly variable in composition, but it consists in general of coarsely sieved ashpit refuse from which glass, cinders, tins, etc., have been removed. The valuable constituents are vegetable and animal residues, *i.e.*, the organic matter other than coal, and the most useful analytical figure is the total nitrogen. Town refuse appears to have its greatest value on heavy soils, on which, if used in dressings of 10 tons or more per acre, its physical effect is good and there is an appreciable manurial action. In the ordinary state it is not considered to be worth more than half the price of stable manure, but there are cases in which town refuse has been graded up by the addition of richer wastes which are higher in fertilizing value and command a better price based on the analysis. Town refuse has given quite good results with mangolds and oats on the heavy soil at Rothamsted. A recent sample

obtained locally contained about 0·8 per cent. total nitrogen and cost 3s. 6d. per ton delivered by lorry on the field.

Further Experiments on Sugar Beet.—An interesting report has recently been published describing experiments on the beet crop carried out at many centres in Ireland during 1927.* A large number of manurial trials and cultivation experiments are recorded, covering in most cases four varieties of sugar beet. The report should be read in detail, but taking the four varieties together the following table may be derived from a section of the data :—

MEAN OF 31 CENTRES. FOUR VARIETIES OF SUGAR BEET. 1927.

<i>Basal dressing per acre</i>	<i>Additional dressing per acre</i>	<i>Yield of washed beet per acre Tons Cwt.</i>	<i>Sugar content per cent.</i>
12 tons Dung 4 cwt. Super. 4 cwt. Kainit	1 cwt. S./Am.	10 6	18·0
	Equiv. Cyanamide	9 17	17·9
	1 cwt. N./Soda	10 1	17·9
	2 cwt. N./Soda	10 10	17·9
	2 cwt. S./Am.	10 11	18·0
12 tons Dung 4 cwt. Kainit 1 cwt. S./Am.	3 cwt. Super.	9 16	17·9
	4 cwt. Super.	10 6	18·0
	5 cwt. Super.	10 5	18·2
	6 cwt. Super.	10 11	18·1
12 tons Dung 4 cwt. Super. 1 cwt. S./Am.	3 cwt. Kainit	10 1	18·1
	4 cwt. Kainit	10 6	18·0
	5 cwt. Kainit	10 8	18·1

An increase in the application of each class of manures showed a tendency to increase the crop, but there was hardly sufficient ground to alter the general recommendation for Irish conditions, *viz.*, 12 tons dung, 4 cwt. superphosphate, 4 cwt. kainit with 1 cwt. nitrate of soda as a top dressing—especially when the plant is suffering from some harmful factor, *e.g.*, disease in early life. No doubt, however, on individual farms the results would suggest useful modifications of the standard dressing. There was an indication that cyanamide was somewhat less effective than equivalent sulphate of ammonia.

Further experiments showed that dung applied in autumn was slightly better than the same amount of dung stored and applied in spring, although the common belief that spring application of dung leads to a large percentage of fangy roots

* *Jour. Irish Dept. Agric.*, Vol. XXVIII, No. 1, 1929.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended April 10.				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	10 13d	10 13d	10 13d	10 13d	13 9
Nitro-chalk (N. 15½%) ..	10 0f	10 0f	10 0f	10 0f	12 11
Sulphate of ammonia :—					
Neutral (N. 20·6%) ..	10 13d	10 13d	10 13d	10 13d	10 3
Calcium cyanamide (N. 20·6%)	9 16e	9 16e	9 16e	9 16e	9 6
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%) .. ..	..	10 10h	..	..	..
Kainit (Pot. 14%)	3 6	2 19	2 19	3 2	4 6
Potash salts (Pot. 30%)	5 3	..	4 17	5 1	3 5
" (Pot. 20%)	3 15	3 9	3 8	3 12	3 7
Muriate of potash (Pot. 50%) ..	9 17	9 3	9 2	9 0	3 7
Sulphate " " (Pot. 48%) ..	11 19	11 6	11 5	11 5	4 8
Basic Slag (P.A. 15½%)|| ..	2 8c	2 2c	..	2 9c	3 1
" (P.A. 14%)|| ..	2 3c	1 16c	1 16c	2 4c	3 2
" (P.A. 11%)|| ..	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26·27½%)	2 10||	2 7||	..	2 5a	1 8
Superphosphate (S.P.A. 16%) ..	3 7	..	3 6	3 6	4 2
" (S.P.A. 13½%) ..	3 2	2 15	3 0	3 0	4 4
Bone meal (N. 3½%, P.A. 20½%) ..	8 15	8 10	8 12	8 2	..
Steamed bone flour (N. ½%, P.A. 27½-29½%)	5 17b	..	6 10	5 10	..

Abbreviations : N. = Nitrogen ; P.A. = Phosphoric Acid ; S.P.A. = Soluble Phosphoric Acid ; Pot. = Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 80% through standard sieve. a. 85% through standard sieve.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots ; at Bristol, f.o.r. Bridgwater ; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra. Rebate of 1s. per ton will be allowed.

e Delivered in 4-ton lots at purchaser's nearest railway station. Rebate of 1s. 3d. per ton will be allowed.

f Prices for 2-ton lots. Rebate of 1s. per ton will be allowed.

A F.o.r. Goole.

was not confirmed in these trials. As a mean of 84 centres a top dressing of 1 cwt. nitrate of soda increased the crop by 9 cwt. per acre and had practically no effect on the sugar content. Individual centres differed widely in their response to this top dressing, and each case should be considered in relation to the state of cultivation of the land and the condition of the plant in its early stages. At four centres, where increasing dressings of nitrate were used, there was no evidence that quantities in excess of 1 cwt. per acre were required, and there was a tendency for the higher dressing (3 cwt. per acre) to depress the sugar content. There was no benefit at the above centres from applying the kainit in the autumn, or from substituting basic slag for superphosphate.

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NOTES ON FEEDING STUFFS

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The Pig's Dietary.—Time was when the staple ingredients of the pig's diet in this country consisted of barley meal, middlings and dairy by-products. This somewhat restricted dietary has, however, undergone considerable extension, as a result of the introduction of sundry feeding stuffs which arise as by-products of industries concerned with the preparation of foods for human consumption. The following notes deal with the composition and uses of some of these products.

Fish Meal.—Of the materials which have been added to the list of pig-feeding stuffs during recent years, special interest attaches to fish meal on account of the controversies to which its use by the stock-feeder has given rise. It was in the year 1892 that the Norwegian Government carried out the first tests on the use of fish waste as an animal food. The gradually increasing demand for this product on the Continent led to the establishment of the fish meal industry in this country in 1905; but it was not until 1916, under war-time conditions, that home-feeders of stock really began to avail themselves of this feeding stuff.

White fish meal is defined as "a product (containing not more than 6 per cent. of oil and not more than 4 per cent. of salt) obtained by drying and grinding or otherwise treating waste of white fish, and to which no other matter has been added." Chemical analysis reveals that it contains more than 50 per cent. of protein and about 20 per cent. of mineral matter, the

latter being mainly composed of phosphate of lime. It is to these features that the special value of fish meal as a food for growing animals and dairy cows is to be attributed. Fish meal is an excellent supplement to grain, grain offal and potatoes, because it provides protein, of which rather more than 90 per cent. is utilized by the animal, and mineral matter, in both of which these feeding stuffs are deficient. Several writers have attempted to explain the striking influence of fish meal on the rate of growth of the pig by attributing a high vitamin content to this feeding stuff. This contention, however, is very dubious. The requirement of the pig for vitamin A is so small that any properly balanced ration will supply the needs for this factor. Moreover, it is doubtful whether white fish meal is to be regarded as a rich source of vitamins.

More important from the economic standpoint is the question whether the use of fish meal leads to tainting of the carcass of the animal. The work of Dr. Orr and Mr. Crichton has shown conclusively that white fish meal, if entirely made from the heads, bones and flesh of white fish, produces no taint in bacon, pork, milk, eggs or chicken flesh. All risk of tainting the carcass disappears if the use of fish meal be discontinued during the last month of fattening.

In view of the high protein content of white fish meal, it should be fed only in small quantities, which will supply the animal's requirements for this constituent. A supply of fish meal greatly in excess of the animal's needs is not only wasteful but may easily lead to harmful results. The ration of the pig should not contain more than 4 to 8 ounces of fish meal per day, according to size. As a result of numerous feeding trials, Dr. Crowther has formulated a series of standard rations, based on barley meal, middlings and fish meal, to meet the requirements of pigs at different stages of growth. From the 8th to the 16th week, fish meal constitutes 15 per cent. of the total ration; from the 16th to the 24th week, 10 per cent.; from the 24th to the 28th week, 5 per cent. In the final stages, fish meal is omitted altogether, not because of risk of taint, but because it does not pay.

In view of the high cost of white fish meal, and also because of the difficulties which may arise when bacon factories put a veto on the use of fish meal towards the end of the fattening period, it is but natural that attempts should have been made to replace fish meal by less expensive substitutes. Professor Paterson and Mr. Cochrane have shown that a mixture of

decorticated earth nut meal and a little steamed bone flour constitutes an efficient and economical substitute for fish meal. The late Mr. K. J. J. Mackenzie successfully used palm kernel cake meal containing a small proportion of blood meal. Combined researches into the rearing of pigs, conducted by Mr. Davidson, Professor Wood, Dr. Crowther and Dr. Orr, have demonstrated that extracted soya bean meal, when supplemented with mineral mixtures, gives results as good as those obtained by the use of fish meal.

A second grade of fish meal is made from the refuse of herrings, mackerel and other oily fish. Such fish meal, containing 10 to 20 per cent. of oil, is not desirable for feeding purposes on account of the risk of taint. The so-called herring fish meal, if made from salted herring, often contains large amounts of common salt, which may affect the health of the animals adversely. Oily fish meal is presumably rich in vitamin A, although, on account of the small requirement of the pig for this growth factor, this feature possesses no special interest for the pig-feeder.

Dried Blood.—This by-product of the slaughter-house comes into the market as a dark brown powder containing about 80 per cent. of protein, the rest of the material consisting mostly of moisture. It is found to constitute an excellent supplement to grain and grain offals in the rations of young swine when fed at the rate of 1 to 2 ounces per day. Quantities larger than this should not be fed owing to its extremely high content of protein.

Meat Meal.—This is produced by drying and grinding the refuse, other than bones, in factories where meat is canned or where meat extract is made. It contains 70 per cent. of protein (which being flesh protein is very efficient in producing growth in young animals) and 10 to 15 per cent. of fat. A good meat meal containing not too much fat is probably the best substitute which can be found for fish meal. For this purpose, however, it is usually necessary to bring up the percentage of mineral matter by the addition of steamed bone flour, or, alternatively, by including whey in the ration.

Carcass Meal.—This is obtained when the bones are ground up with the refuse meat. It contains 50 per cent. of protein, 15 per cent. of fat and about 20 per cent. of mineral matter. The latter, as with fish meal, consists mainly of phosphate of lime.

Dried Yeast.—This feeding stuff, which results from the drying of waste yeast from the breweries, contains about

50 per cent. of protein, practically no fibre and oil, and roughly 10 per cent. of mineral matter. It is particularly rich in vitamin B. On account of its richness in protein, it should be fed only in small quantities, and in the diet of the pig not more than 4 to 8 ounces should be included. Dr. Crowther and the writer have shown that sheep are able to digest and assimilate nearly 90 per cent. of the protein in dried yeast. A consideration of the nature of this protein, however, leads to the belief that this constituent as found in dried yeast cannot be so efficient for growth purposes as is the protein of fish meal or meat meal. It is of interest to recall the success which attended the efforts of the German scientist during the years of war-time to manufacture this protein concentrate on a large scale by allowing a special variety of yeast to grow in solutions containing beet molasses and sulphate of ammonia, the latter having been made synthetically from the nitrogen of the air. By these means, atmospheric nitrogen was indirectly transformed into a valuable nitrogenous food, which in turn underwent conversion into milk and flesh protein in the bodies of farm animals.

Maize Meal and Flaked Maize.—The fattening properties of maize meal are well known. Maize, however, contains only a low percentage of protein and is also deficient in mineral ingredients. For these reasons, even when it is desired to fatten well-grown pigs, much larger and more economical gains are possible when maize is properly supplemented by feeding stuffs rich in protein and mineral matter, especially lime compounds. Owing to its tendency to produce a soft pork, it is advisable that maize should be fed in moderation to fattening pigs.

In work on pig-feeding, the writer has shown that for fattening purposes maize meal is about 12 per cent. more efficient than barley meal. Little difference was found between the digestibility of dry crushed maize and the soaked feeding stuff. Soaking is desirable, however, to prevent wastage of food and unnecessary expenditure of energy during mastication. The cooking of maize before feeding results in such a small increase in nutritive value that the procedure is to be regarded as uneconomical.

Flaked maize is made from the maize grain by successive processes of steaming, rolling and drying. It consists of crisp yellow flakes which are composed almost entirely of very digestible protein and soluble starch. Experiments carried out by the writer have shown that 95 per cent. of the dry

substance of flaked maize is digested by swine as compared with the figure of 87 per cent. for raw maize. For purposes of fattening in pigs, flaked maize may be regarded as a 10 per cent. better feeding stuff than raw maize. In replacing barley meal by flaked maize in pig rations, due attention must be paid to supplementing this product by means of feeding stuffs rich in protein and mineral matter.

Manioc Meal (Tapioca Flour).—Large quantities of this carbohydrate-rich by-product of the cassava root are now finding their way on to the market. This feeding stuff is essentially to be regarded as a source of digestible carbohydrate, and it should only be fed to pigs in conjunction with protein and mineral supplements. An initial prejudice existed against the employment of manioc meal in the feeding of stock, on the grounds that certain varieties of the cassava root are reputed to contain minute traces of a poisonous principle of the nature of a cyanogenetic glucoside. The writer, however, has never heard of any undesirable effects following its use. Farmers who have experience of this product speak well of it and consider it an entirely safe food.

Dried Potatoes and Potato Flakes.—Attempts are to be made in this country to conserve part of the potato crop by a process of artificial drying, a method of treatment which has been practised for some years on the Continent. In this way, it will be possible to utilize profitably the small unsaleable tubers, and further to carry over from one season to another any surplus supply of potatoes which may be secured in a good season. It will be desirable to undertake large-scale feeding trials in order to ascertain the value of the dried product in the feeding of farm animals. On the basis of Kellner's statements in his well-known treatise, the farmer may be encouraged in the belief that the dried potatoes, particularly the potato flakes, will be a valuable addition to the carbohydrate foods available for the feeding of swine.

Root Crops.—Though less use is made of root crops for pig-feeding in this country than on the Continent, the results of feeding trials show that pigs are able to utilize the nutrient matter of roots very efficiently. It has been shown, for instance, that swine are able to digest and utilize 90 per cent. of the food material in mangolds. Quite recently, the writer, in conjunction with Mr. A. N. Duckham and Mr. M. H. French, has completed an investigation into the digestibility and nutritive value of whole sugar beet, dried sugar beet pulp and molasses-sugar beet pulp when fed to swine. The whole

sugar beet, which was grated before feeding in a special machine designed for the purpose, was found to be digested by the pigs to the high extent of 92 per cent., no less than 97 per cent. of the carbohydrate in the sugar beet being assimilated by the animals. This very satisfactory result was further emphasized by the good results which were obtained with growing pigs under farm conditions, when a portion of the barley meal in the rations of the animals was replaced by grated sugar beet.

The surprising discovery was also made that pigs are able to digest dried sugar beet pulp and molasses-sugar beet pulp

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	9 13
Maize	81	6.8	9 19
Decorticated ground nut cake	73	41.0	12 5
„ cotton cake	71	34.0	11 10

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2.57 shillings, and per unit protein equivalent, 1.67 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The “food values” which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1928, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm	
	Per cent.	Per cent.	£	s.
Wheat	72	9.6	10	1
Oats	60	7.6	8	7
Barley	71	6.2	9	13
Potatoes	18	0.6	2	7
Swedes	7	0.7	0	19
Mangolds	7	0.4	0	19
Beans	66	20.0	10	3
Good meadow hay	37	4.6	5	3
Good oat straw	20	0.9	2	13
Good clover hay	38	7.0	5	9
Vetch and Oat silage	13	1.6	1	16
Barley straw	23	0.7	3	0
Wheat straw	13	0.1	1	14
Bean straw	23	1.7	3	2

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	—	—	9 18	0 13	9 5	72	2 7	1-38	9-6
Barley, British feeding ..	—	—	9 15	0 10	9 5	71	2 7	1-38	6-2
" Canadian No. 4 Western ..	36 0	400	10 2	0 10	9 12	71	2 8	1-43	6-2
" " feed	33 6	"	9 8	0 10	8 18	71	2 6	1-34	6-2
" American	32 3	"	9 0	0 10	8 10	71	2 5	1-29	6-2
" Persian	35 9	"	10 0	0 10	9 10	71	2 8	1-43	6-2
Oats, English, white	—	—	10 7	0 11	9 16	60	3 3	1-74	7-6
" " black and grey ..	—	—	10 0	0 11	9 9	60	3 2	1-70	7-6
" Scotch, white	—	—	10 10	0 11	9 19	60	3 4	1-78	7-6
" Argentine	26 9	320	9 7	0 11	8 16	60	2 11	1-58	7-6
" Chilean	27 0	"	9 8	0 11	8 17	60	2 11	1-58	7-6
" German	30 6	"	10 13	0 11	10 2	60	3 4	1-78	7-6
Maize, American	40 6	480	9 10	0 10	9 0	81	2 3	1-20	6-8
" Argentine	44 6	"	10 8	0 10	9 18	81	2 5	1-29	6-8
Beans, English, winter ..	—	—	10 13	1 5	9 8	66	2 10	1-52	20
" Chinese	—	—	11 12	1 5	10 7	66	3 2	1-70	20
Peas, English, blue	—	—	12 10	1 2	11 8	69	3 4	1-78	18
" Japanese	—	—	21 15	1 2	20 13	69	6 0	3-21	18
Dari	—	—	11 0	0 12	10 8	74	2 10	1-52	7-2
Millers' offals—									
Bran, British	—	—	7 15	1 3	6 12	42	3 2	1-70	10
" broad	—	—	9 0	1 3	7 17	42	3 9	2-01	10
Middlings, fine, imported ..	—	—	9 0	0 18	8 2	69	2 4	1-25	12
" coarse, British	—	—	7 15	0 18	6 17	58	2 4	1-25	11
Pollards, imported	—	—	7 12	1 3	6 9	60	2 2	1-16	11
Meal, barley	—	—	10 7	0 10	9 17	71	2 9	1-47	6-2
" maize	—	—	11 0	0 10	10 10	81	2 7	1-38	6-8
" " South African	—	—	10 10	0 10	10 0	81	2 6	1-34	6-8
" " germ	—	—	10 5	0 16	9 9	85	2 3	1-20	10
" locust bean	—	—	9 10	0 8	9 2	71	2 7	1-38	3-6
" bean	—	—	12 15	1 5	11 10	66	3 6	1-87	20
" fish	—	—	19 10	3 9	16 1	53	6 1	3-26	48
Maize, gluten feed	—	—	10 15	0 10	10 5	85	2 5	1-29	8-6
" cooked flaked	—	—	12 10	1 0	11 10	76	3 0	1-61	19
Linseed cake, English, 12% oil ..	—	—	13 15	1 10	12 5	74	3 4	1-78	25
" " " 9% "	—	—	13 5	1 10	11 15	74	3 2	1-70	25
" " " 8% "	—	—	12 17	1 10	11 7	74	3 1	1-65	25
Soya bean " " 5 1/4% " ..	—	—	11 15	2 2	9 13	69	2 10	1-52	36
Cottonseed cake, English—									
Egyptian, 4 1/4% "	—	—	7 17	1 9	6 8	42	3 1	1-65	17
" " Egyptian, 4 1/4% " ..	—	—	7 15	1 9	6 6	42	3 0	1-61	17
Decorticated cottonseed meal ..	—	—	12 5*	2 3	10 2	74	2 9	1-47	35
7% oil	—	—	11 5	1 5	10 0	79	2 6	1-34	16
Coconut cake, 6% oil	—	—	10 0†	1 8	8 12	57	3 0	1-61	27
Ground-nut cake, 6-7% oil ..	—	—	12 5†	2 3	10 2	73	2 9	1-47	41
Decorticated ground-nut cake, ..	—	—	9 15†	0 18	8 17	75	2 4	1-25	17
6-7% oil	—	—	10 5†	0 18	9 7	75	2 6	1-34	17
Palm kernel cake, 4 1/4-5 1/4% " ..	—	—	9 7	0 19	8 8	71	2 4	1-25	17
" " meal, 4 1/4% "	—	—	6 0	0 9	5 11	51	2 2	1-16	2-7
Feeding treacle	—	—	8 17	1 0	7 17	49	3 2	1-70	13
Brewers' grains, dried ale ..	—	—	8 7	1 0	7 7	49	3 0	1-61	13
Malt culms " " " porter ..	—	—	7 15*	1 8	6 7	43	2 11	1-56	16

* At Bristol.

† At Hull.

‡ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of March and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 23-4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1-43d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 6d.; P₂O₅, 8s. 10d.; K₂O, 3s. 5d.

to an extent very little inferior to that to which ruminant animals are able to digest these feeding stuffs. Despite this finding, however, it was clear that sugar beet pulp, although a good source of carbohydrate for sheep, bullocks and dairy cows, is by no means a suitable food for pigs. Its inclusion in pig rations, even in moderate amount, causes the mixed food to be very bulky after the usual soaking in water. This leads to difficulties in securing satisfactory consumption of the food, and it is found that pigs, in consequence of the well-known difficulty they experience in dealing with bulky foods, are unable to consume as big a ration as is possible when sugar beet pulp is omitted. For this reason, pigs cannot make the maximum rate of live-weight increase when sugar beet pulp is included in their dietary, although it is possible that both forms of beet pulp would prove satisfactory for feeding in moderation to old sows. It is hoped to publish shortly, in the *Journal of Agricultural Science*, a full account of these pig-feeding trials with sugar beet, dried sugar beet pulp and molasses-sugar beet pulp.

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MISCELLANEOUS NOTES

THE Ministry of Agriculture and Fisheries is prepared to receive, not later than 15th of this month (May), applications for grants in aid of scientific investigations bearing on agriculture to be carried on in connexion with a University, University College or other approved Institution or Society in England and Wales during the academic year commencing October 1, 1929. The conditions on which these grants are offered are set out in the prescribed form of application (A.53/T.G.), copies of which may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

* * * * *

THE Ministry of Agriculture and Fisheries invites applications, for agricultural scholarships, from students who propose to take up posts as agricultural organizers, teachers or lecturers in agriculture, etc. The scholarships are tenable for two years from October 1, 1929, the second year of which will normally be spent abroad. The value of the scholarships will vary according to the scholar's means, but will not exceed £200 per annum whilst the scholar

Agricultural Scholarships

is in this country ; extra allowances may be made for travelling and subsistence for periods spent abroad. The number to be awarded will not exceed five, and will depend upon the qualifications of the candidates. Applications can be received up to June 15, 1929, on the prescribed form (A.472/T.G.) which, together with a copy of the conditions attaching to the scholarships, may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

* * * * *

THE general level of prices of agricultural produce in March was 43 per cent. above that of the base years, 1911-13, or 1 point lower than in February and 2 points lower than in March, 1928. Fat pigs showed a further rise in price during the month under review, and potatoes were dearer, while eggs maintained a higher average than usual at this period of the year. The reduction in the milk contract price, however, was more than sufficient to counter-balance the effect of these upward movements and the net result was a fall in the general index number.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1924 :—

		Percentage increase compared with the average of the corresponding month in 1911-13					
Month		1924	1925	1926	1927	1928	1929
January	..	60	71	58	49	45	45
February	..	61	69	53	45	43	44
March ..	..	57	66	49	43	45	43
April ..	..	53	59	52	43	51	—
May ..	..	57	57	50	42	54	—
June ..	..	56	53	48	41	53	—
July ..	..	53	49	48	42	45	—
August ..	..	57	54	49	42	44	—
September	..	61	55	55	43	44	—
October	..	66	53	48	40	39	—
November	..	66	54	48	37	41	—
December	..	65	54	46	38	40	—

Grain.—Wheat was 1d. per cwt. cheaper than in February at 9s. 8d. per cwt. and barley 2d. cheaper at 10s. 2d. per cwt. The index number of the former fell by 1 point to 30 per cent. above pre-war, while the latter remained unaltered at 28 per cent. Oats were unchanged at 9s. 8d. per cwt. and 36 per cent. dearer than in March, 1911-13. Wheat maintained

the same level as a year ago, but barley and oats were appreciably cheaper.

Live Stock.—There was very little alteration in the average prices of fat cattle and sheep from those ruling in the previous month, but in both cases the base prices in 1911–13 showed a rise, with the result that the index number for fat cattle was 1 point lower in March at 33 per cent. above 'pre-war, and for fat sheep it was 4 points lower at 52 per cent. Bacon and pork pigs made appreciably higher prices than in February, and the relative index numbers were higher, by 8 and 6 points, at 58 and 66 per cent. respectively. Store cattle and sheep were dearer than in the previous month, but as in neither case was the increase proportionately so large as in the base period, the index numbers showed a fall of 1 point. Store pigs, however, were 1 point higher on the month at 57 per cent. above 1911–13, as compared with 35 per cent. a year earlier. Dairy cows were nearly 30s. per head cheaper than in February, and the index number declined by 3 points to 30 per cent. above pre-war.

Dairy and Poultry Produce.—Under the agreement made between producers and distributors for the contract year 1928–29 the price of milk delivered during March was fixed at 16d. per gallon as against 17d. in February, and the index number for milk showed a decline of 10 points for the month under review. Butter was 1 point higher at 54 per cent. more than in the base years, and cheese was unaltered at 74 per cent. Eggs were about 3½d. per dozen cheaper than in February, but as the reduction was not nearly so sharp as in the corresponding period of the base years, the index number was higher at 93 per cent. above pre-war. A year ago the index number was only 26 per cent. above the base years. Poultry averaged 40 per cent. more than in 1911–13, or the same as in March, 1928.

Other Commodities.—The restriction of supplies of potatoes and the doubtful condition of many consignments resulting from the severe weather conditions in February and the early part of March led to a rise in prices, and potatoes were about 10s. per ton dearer during the month under review, the relative index rising by 11 points to 40 per cent. above pre-war. The rise in the prices of vegetables was very extreme, the average level being over two-and-a-half times that of 1911–13. Hay was a little dearer than in February at 7 per cent. above the pre-war level. Wool declined by 9 points to 60 per cent.

Index numbers of different commodities during recent months and in March, 1927 and 1928, are shown below :—

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1927	1928		1929		
	March	March	Dec.	Jan.	Feb.	March
Wheat	57	30	31	30	31	30
Barley	38	36	24	26	28	28
Oats	14	49	29	34	36	36
Fat cattle	26	38	27	35	34	33
Fat sheep	45	61	50	67	56	52
Bacon pigs	63	40	26	40	50	58
Pork pigs	76	45	36	52	60	66
Dairy cows	25	31	34	33	33	30
Store cattle	27	23	21	23	23	22
Store sheep	41	47	49	59	57	56
Store pigs	116	35	30	52	56	57
Eggs	39	26	37	56	68	93
Poultry	34	40	45	45	41	40
Milk	56	56	71	70	70	60
Butter	40	47	50	53	53	54
Cheese	36	65	79	78	74	74
Potatoes	85	82	45	31	29	40
Hay	0	12	8	6	4	7
Wool	33	70	66	72	69	60

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For several years past, Sir John Russell, the Director of the Rothamsted Experimental Station, has issued a cordial invitation to Associations of Farmers and

**Demonstrations
to Farmers and
Others at
Rothamsted and
Woburn**

Farm Workers, Chambers of Agriculture and Horticulture, Students' Societies and other bodies interested in Agriculture and Horticulture, for summer visits to the experimental plots at Rothamsted and Woburn. He has renewed the invitation

for visits during the coming summer, Mr. H. V. Garner, M.A., B.Sc., and Capt. E. H. Gregory being available to demonstrate the plots at any time, and under their guidance visitors should find an inspection both useful and interesting.

At Rothamsted, where the soil is heavy, the experiments deal with the manuring of arable crops, especially sugar beet, potatoes, mangolds, barley, oats, wheat; the manuring of meadow hay; the effect of modern slags and mineral phosphates on grazing land and hay land; inoculation of lucerne; crop

diseases and pests ; demonstrations of modern implements ; tractors and good types of tillages. There are also experiments in progress on the laying down of land to grass. The light soil at Woburn is devoted to experiments more particularly concerned with the manuring of potatoes, sugar beet, malting barley, and the use of green manures. The most convenient period for visits is from now to the end of October. A full day can be spent at either place, even if the weather proves too bad to allow of close investigation of the fields ; but it is not possible to see both stations on one day.

The Director will be happy to arrange full details for visits from the organizations mentioned, and small groups of farmers will be specially welcomed. Notice of intended visits, well in advance, are desired, if possible, to avoid the possible clashing of dates, but as farmers' movements are often governed by the weather, no farmer need stay away because he has been unable to fix a date beforehand. All communications should be addressed to the Secretary, Rothamsted Experimental Station, Harpenden, Herts.

* * * * *

THE Ministry invites applications for research scholarships in agricultural and veterinary science. The scholarships are tenable for three years from October 1, 1929, and are of the value of £200 per annum ; extra allowances may be made for travelling and subsistence for periods spent abroad. The number to be awarded will not exceed seven and will depend upon the qualifications of the candidates.

**Agricultural and
Veterinary
Research
Scholarships**

Applications must be received not later than June 15, 1929, on the prescribed form (900/T.G.), which, together with a copy of the conditions attaching to the scholarships, may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

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THE Ministry of Agriculture and Fisheries invites applications for the Alfa-Laval Scholarship in Dairy Engineering. The scholarship is of the value of £100 a year, and is tenable for four years from October 1, 1929. The first three years will be spent in studying mechanical engineering, with as far as possible a dairy bias, and the fourth in specialized training in Sweden. Candidates are required to

**Alfa-Laval
Scholarship in
Dairy
Engineering**

be men of British parentage, and either to be graduates in agriculture with dairy qualifications or to have passed the National Dairy Diploma examination. Applications can be received up to June 15, 1929, and must be on the prescribed form, which, together with a copy of the conditions relating to the scholarship, may be obtained from the Secretary, Ministry of Agriculture, 10 Whitehall Place, London, S.W. 1.

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THE Seed Potato Sub-Committee of the Northern Provincial Advisory Conference has been considering recently the possibilities of extending the existing
Northern English Seed Potato Trials market for Northern English seed potatoes and has circulated to county education authorities an invitation to establish local trials with a view to testing the merits of seed potatoes grown in the northern area. Thirteen local education authorities have signified their willingness to arrange for carrying out such trials. The varieties to be tested are Great Scot, Field Marshal, King Edward VII and Kerr's Pink. Specially selected seed is being supplied and arrangements are being made for the co-ordination of the reports of the trials.

* * * * *

THE Fourth Annual Report of proceedings under the Agricultural Wages (Regulation) Act, 1924, has now been issued, and copies are obtainable from
Agricultural Wages Report H.M. Stationery Office, Adastral House, Kingsway, or through any Bookseller, price 1s. net.

The Report contains details of the minimum rates of wages in force for agricultural workers in the various counties in England and Wales during the year ended September 30, 1928. In addition to a brief account of the work of the Agricultural Wages Board and of the county Agricultural Wages Committees, there is a short note dealing with the state of employment in Agriculture, and, in an Appendix, particulars are given of the work of the International Labour Conference in so far as it affects the agricultural worker. The action taken by the Ministry during the year to secure the observance of the Orders made under the Act is

reviewed in one section of the Report ; and another section is devoted to rulings given by the Courts in cases which have a bearing on the interpretation of "agriculture" for the purpose of the Act.

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending April 15 legal proceedings were instituted against seven employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board.

Particulars of the cases are as follows:—

County	Court	Fines			Costs			Arrears of wages			No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	d.	
Chester ..	Knutsford ..	0	10	0	2	2	0	30	0	0	1
Lancs ..	Church ..	3	0	0	—	—	—	75	16	0	3
" ..	Lytham ..	*	—	—	0	2	0	12	2	10	2
Salop ..	Shrewsbury ..	—	—	—	0	14	0	15	0	0	1
Yorks, W.R.	Leeds ..	5	0	0	5	11	0	9	8	6	2
Carmarthen.	Carmarthen.	1	0	0	—	—	—	7	15	0	1
" ..	Llandovery.	*	—	—	1	13	0	7	0	0	1
		£9 10 0			£10 2 0			£157 2 4			11

* Dismissed under the Probation of Offenders Act.

* * * * *

Foot-and-Mouth Disease.—An outbreak was confirmed on March 24 at Anerley, Penge, Kent, and the usual restrictions were applied to an area of approximately 15 miles radius round the infected premises. This area included the whole of the County of London except the parishes of Poplar Borough, St. John at Hackney, and Stoke Newington.

No further outbreaks having occurred either in the Lines (Kesteven) infected area—referred to in the April issue of this JOURNAL—or in the above-mentioned area in Kent, the restrictions in force in those areas were withdrawn on April 1 and 22 respectively, and the position, as this issue of the JOURNAL goes to press, is that, as from the latter date, no general movement restrictions remain in force in connexion with foot-and-mouth disease in any part of Great Britain.

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APPOINTMENTS: CHANGES AND CORRECTIONS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Devon : Mr. E. V. Beard has been appointed Assistant Instructor in Poultry-Keeping, *vice* Mr. W. Heale.

Miss M. E. Cumming, N.D.D., N.D.P., has been appointed to the new post of Assistant Instructress in Dairying and Poultry-Keeping.

Suffolk (East and West) : Mr. H. D. Day has been appointed to the staff of West Suffolk as Instructor in Poultry-Keeping, to act as Joint Instructor for East and West Suffolk.

Miss C. E. Speakman, N.D.D., Instructress in Dairying and Poultry-Keeping for East Suffolk, is to act as Joint Instructress in Dairying for both Counties.

COUNTY AGRICULTURAL EDUCATION STAFFS : WALES

Denbigh : Miss A. Davies, N.D.D., has been appointed Instructress in Dairying.

Miss E. M. Lloyd, N.D.D., has been appointed Assistant Instructress in Dairying.

Mr. L. C. S. Ross has been appointed Instructor in Poultry-Keeping.

Carmarthen : Miss A. V. Griffith, N.D.D., has been appointed Instructress in Dairying.

Merioneth : Mr. William Evans has been appointed Instructor in Agricultural and Rural Science.

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NOTICES OF BOOKS

Farm Buildings.—By W. A. Foster and Deane G. Carter. Second Edition. Pp. xviii+358. (New York: John Wiley & Sons. London: Chapman & Hall. 1928. Price 15s. net.)

It is always stimulating to explore the courses followed by people who have been faced by problems generally similar to our own, and where the outlook is as fresh and advanced as in this American publication there is much benefit to be gained.

The book is in the main intended as a text-book for technical courses in agriculture; it contains a combination of economics, farming and building construction, and on each topic the information given is valuable and well-presented, though in many instances not adaptable to the practices of this country.

There is perhaps a trace of irony in the pronouncement that there is a "growing tendency among economists to regard farming as a business rather than as a mode of living," but following on from that it is demonstrated how important in dollars are farm buildings, which commonly are of greater combined value than the implements, machinery and live stock taken together. "Build on paper first" is the conclusion of this argument, which recalls an amusing definition of an architect as "A man who for a very moderate fee draws lines with a fourpenny pencil on a threepenny piece of paper, and rubs them out with a twopenny lump of rubber solely to prevent his client from making costly mistakes with expensive materials or valuable land."

All forms of buildings, from poultry houses to "Dairy barns" (not so nice a name as "byres"), are dealt with in detail, the chapters on Hoghouses and Silos being especially good and full of useful tables and diagrams. In considering double rank cowstandings, the perennial rival claims of "face in" and "face out" are again fully considered, but curiously one of the strongest points for tail to tail standing—that cows do not breathe over one another—is altogether omitted. This may be due to the common adoption of a definite ventilation system, with air trunks and exhaust cowl, consequent on the need for closed windows during winter and the usual American practice of building the fodder barn as an upper storey to the cowhouse, which itself apparently arises from a joint desire to save expense and to keep the stock warm during severe winter weather. It is apparently recognized that when certified milk is to be produced the dust arising from the upper storey is detrimental. From some practical experience of the quantity of dust and litter which a comparatively short ventilating flue can accumulate in the course of a year or so, the opinion might be held that such hidden spaces are also a source of danger unless provision is made for adequate access for cleaning.

There are things shown in this book which it would be difficult to find elsewhere, such as details of feeding floors for pigs, feeding racks of various types, breeding crates, self-levelling drinking troughs, good and bad types of drainage channels, and so forth. Not every detail shown will commend itself in this country, either from a building or farming point of view, but no one can be the worse for thinking about them, and apart from these a quantity of useful data make the book one for handy reference.

International Directory of Pedigree Stock Breeders. (London: The Vernon Press, Ltd. Price 25s. net.)

This is a second and revised edition of a book which contains alphabetical lists of the names and addresses of breeders of all classes of pedigree live stock in all parts of the world. The book, which is well illustrated, contains interesting information as to live stock breeding in the different countries, and descriptions of the various breeds of stock, together with articles on general topics connected with breeding.

The Gardeners' Year Book, 1929.—Edited by D. H. Moutray Read, F.R.H.S. pp. 318. (London: Philip Allan & Co. Price 5s. net.)

The current edition of this Year Book contains information that is of real value to those connected with the Horticulture Industry, and the subject matter shows a decided improvement on the previous issue. The Botanic Expeditions that have taken place during the year, new and noteworthy plants in the Wisley Trials, reports from Horticultural Experiment Stations, lists of Horticultural Institutions, Colleges and Schools, Societies, Botanic Gardens and Standard Reference books on Horticulture are among the matters included. In addition there are really interesting articles on some selected gardens, plant sanitation, and very trustworthy and informative articles on Perpetual Flowering Carnations, Fruit for small gardens, Sweet Peas, Tomato Growing, etc.

This much improved book can be read with interest and profit by all interested in gardening and should be retained for future reference.

"The Feathered World" Year Book, 1929. Pp. 592. (London: "The Feathered World," 9 Arundel Street, W.C. 2. Price 2s.)

This useful annual contains many articles of interest and instruction for poultry-keepers. Its contents are very varied and the contributors well known in the poultry world. Among these the following may be mentioned. Mr. S. H. Lewer reviews "The Year that has Passed," noting in particular the plans which are maturing for the forthcoming World's Poultry Congress, the activities of the National Poultry Council and of the National Poultry Institute, and the important advance in egg marketing embodied in the Agricultural Produce (Grading and Marketing) Act, which received the Royal Assent last August. Mr. T. R. Robinson describes a number of "Continental Breeds," with special reference to Geline de Touraine, Gournay and Welsummers. Mr. J. S. Hicks contributes a chapter on "Table Poultry," and Professor R. T. Parkhurst writes on "Capons and Caponizing." The question of "Costings" is dealt with by Captain D. J. H. Cloran, and "The Commercial Poultry Farm of the Future," by Mr. J. H. Dowden. Mr. Powell Owen contributes a chapter on "Breeding for Heavy Egg-Production." Other articles deal with turkeys, ducks, waterfowl and pigeons. There are also a number of articles and notes dealing with the various breeds, and a collection of facts and figures which combine to form a practical work of reference for the poultry-keeper.

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NOTES FOR THE MONTH

THIS Act, which received the Royal Assent on May 10, 1929, is designed to deal with the drainage of the low-lying area round the county borough of Doncaster. Part of the area, well-known as Hatfield Chase, was first reclaimed from a condition of swamp by the famous Dutch engineer, Sir Cornelius Vermuyden, who was also responsible for the original reclamation of the Great Ouse fenlands. At Hatfield Chase, Vermuyden cut new courses for the principal rivers and constructed a very ingenious and complicated system of pumps and sluices in order to get the waters from the swamp area into the main rivers and drains which flow at a considerably higher level.

The Vermuyden system still stands, but its efficiency has in modern times become increasingly endangered owing to the development of coal mining below the surface of the Doncaster area. Seven collieries are now in existence, and further subsidence of land, already below the level of its drainage outfalls, must inevitably occur. The problem was brought to the notice of the Royal Commission on Mining Subsidence and, as a result of a recommendation of this Royal Commission, a special Commission was set up to investigate the Doncaster area problem. The special Commission, on which all the interests concerned were represented, presented a unanimous Report in February, 1928.

The Act which has now received the Royal Assent follows that Report closely in all essentials and has two main objects. The first is to constitute a comprehensive drainage authority with all the powers of such an authority under the general land drainage Acts, to be known as the Central Board, to deal with the whole area concerned. The Board will have direct control of the main rivers and drains, and will also exercise general supervisory powers over the numerous existing drainage authorities within the area. The second object is to impose a definite liability on the mining interests to pay for works to repair damage caused to the drainage system by any subsidence

or to meet anticipated subsidence, and also to create a fund to meet the cost of such works after a mine has ceased to be worked.

It is not anticipated that the Act will conflict in any way with the general legislation based upon the Report of the Royal Commission on Land Drainage, with which it is intended to proceed in due course, as the Doncaster Board can easily be linked up with any larger schemes that may be initiated to deal with a whole catchment area. The Doncaster problem, being both urgent and exceptional, called for an urgent and exceptional solution, and this it is hoped will be provided by the Act.

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THE National Mark Scheme for Apples and Pears came into effect on September 1, 1928, and ran a very successful course during its first season. At the

National beginning, it was agreed that the Scheme
Mark Fruit was not necessarily in its final form, and
Scheme : that at the end of twelve months' working

Apples and Pears a reconsideration of the terms and conditions under which packers were permitted to apply the Mark should be considered jointly by the Ministry and the National Farmers' Union, in the light of experience gained during that initial period. This course has been followed, and agreed amendments have been adopted which take effect forthwith. Summarized briefly, the essential amendments are as follows :—

(1) *Quantity Qualifications*.—The output required by a fruit grower or packer before permission to use the National Mark can be obtained has been reduced, in respect of apples to 750 bushels (or 15 tons) and in respect of pears to 400 bushels (200 bushels in the case of the variety "Doyenne du Comice").

(2) *Varieties*.—The "Rev. Wilks" is now transferred from the dessert to the culinary varieties. Small sizes of the culinary varieties, "Gascoyne's Scarlet," "Newton Wonder," "Annie Elizabeth" and "Edward VII," may be packed according to the regulations for dessert varieties, in which case the word "Dessert" must appear on the National Mark label.

(3) *Grading*. (a) **SIZE**.—The minimum diameter required for "Fancy" dessert apples has been reduced from $2\frac{1}{4}$ in. to 2 in. There is also $\frac{1}{4}$ in. reduction in the minimum

diameter for dessert pears (other than "Conference" shape), the size now being fixed at $2\frac{1}{4}$ in. for "Extra Fancy" and $2\frac{1}{4}$ in. for "Fancy" and "C" grade pears.

(b) COLOUR.—For those grades of fruit in which a colour requirement is imposed, the definition of uniformity has been amended by the addition of the word "reasonably," and the colour must therefore be "reasonably uniform" throughout each package. In the case of "Fancy" dessert apples, a reduction has been made in the requirement as regards the total surface coloured, and varieties which are known to colour wholly red are now to average not less than 10 per cent. coloured, no apple to be less than 5 per cent., while varieties which partly colour red are to average 5 per cent. coloured.

(4) *Packs*.—Wider use is now allowed of the $\frac{1}{2}$ and $\frac{1}{4}$ apple boxes, both being permitted in respect of "Extra Fancy" and "Fancy" cooking apples, the $\frac{1}{4}$ box being also allowed in respect of "C" grade dessert pears and "Fancy" cooking pears.

(5) *Packages*.—No material revision is made of the specifications of packages. Minor alterations now allow an option in the thickness of the wood for $\frac{1}{2}$ and $\frac{1}{4}$ boxes.

Full particulars of the National Mark Scheme for Apples and Pears, as revised, are to be found in Marketing Leaflet No. 7, which may be obtained, free of charge, on application to the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W. 1.

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DURING April a deputation of the Pig Industry Council, consisting of Lord Folkestone, Mr. Baxter, Mr. Black, Mr. A. E. Marsh and Col. F. S. Kennedy Shaw,

Pig Industry Council

paid a short visit to Sweden, Denmark and Holland to examine the pig-recording and strain-testing systems in operation in those countries and other matters affecting the industry. The deputation was accompanied by Mr. Dixon and Major Orme of the Ministry. The report which the party has now presented to the Council contains recommendations dealing with breeding, feeding, management, diseases and marketing, some of which are already before the Ministry. The report shows that the party was particularly impressed with the Continental system of housing and management, and notably that found in Sweden.

IN the July, 1927, issue of this JOURNAL, a description was given of the Canadian Wheat Pool. Recent information indicates that an attempt is being made to secure, by means of legislation, the compulsory marketing of all wheat through the Wheat Pool. The chief support for this proposal comes from the Saskatchewan Section of the United Farmers of Canada, who appear, in this matter, to be acting against the advice of a number of their permanent officials. The proposal is supported on the ground that it makes for the greatest good of the greatest number, but is opposed as being contrary to co-operative principles. It does, however, contain conditions intended to safeguard the interests of the owners of non-contract wheat secured by compulsion, who have no financial interest in the Pool's assets and liabilities.

* * * * *

IN order to encourage the trade in home-grown seeds exported to the Colonies, the Ministry has made arrangements, with the assistance of a grant from the Empire Marketing Board, that in cases where the Colonial Import Regulations require that consignments of seeds shipped from this country shall be accompanied by a certificate of test carried out at a British Official Seed Testing Station, such test may be made at Cambridge free of charge.

During the 1928-29 season, i.e., from April 1, 1928, to March 31, 1929, some 1,099 samples have been sent for the free test. These included 104 samples of grasses and clovers, 165 of mangolds and beet, and 830 of vegetable and pulses.

Samples sent to the Official Seed Testing Station, Huntingdon Road, Cambridge, for these free tests, should be of the normal quantities sent for testing, and must be accompanied by a statement to the effect that the bulks from which the samples are drawn are intended solely for export to a named colony, and that the sender guarantees that the certificates issued by the Official Station in respect of these samples will be used for no other purpose than in connexion, with the export to the country specified, of the bulks from which the samples are drawn.

THE annual agricultural returns will be collected this year on June 4. These returns are compulsory under the provisions of the Agricultural Returns Act, 1925, and every occupier of more than one acre of agricultural land, which includes orchard land, market gardens and nurseries, is required to make a return.

**Annual Returns
of Crops and
Livestock**

The forms for the returns will be issued immediately before June 4, and when completed they should be forwarded to the Crop Reporter whose address appears on the back of the form. It is hoped that all occupiers will make their returns promptly so that there may be as little delay as possible in the publication of the tabulated results.

The Act provides that no individual return or part of a return may be used, published or disclosed except for the purposes of the preparation and publication of agricultural statistics, or of prosecutions under the Agricultural Returns Act.

* * * * *

A COURSE of instruction in the principles and practice of seed testing will be held at the Official Seed Testing Station for England and Wales, Huntingdon Road, Cambridge, beginning on June 25 and ending on July 23. The course will be followed by an examination on July 24 and 25. Particulars, syllabus and application form can be obtained from the Secretary, National Institute of Agricultural Botany, Huntingdon Road, Cambridge.

* * * * *

WITH the object of preventing the introduction of the Cherry Fruit Fly, the Minister has made an Order under the Destructive Insects and Pests Acts, 1877 to 1927, regulating the importation of cherries into England and Wales during the 1929 season.

**Importation of
Cherries**

Cherries grown in France will be admitted without restrictions until June 15, after which date those grown in the Southern Zone will be prohibited. This Zone consists of seventeen Departments, including the whole of the Departments of Ardèche and Drôme. Cherries from the Central Zone (21 Departments) will be admitted until June 20, and those grown in the Northern Departments until July 6, after which date the importation of French cherries will be prohibited, except of those grown within a small district around Honfleur, details of which appear in the Order.

Cherries grown in Italy will be admitted without restrictions until June 10, after which date those grown in the Region of Apulia will be prohibited. Cherries from the Regions of Basilicata, Calabria and Campania will be admitted until June 20, and those grown in the remainder of Italy until June 30, after which date the importation of Italian cherries will be entirely prohibited.

Cherries grown in any other European country, and imported after June 15, must be accompanied by certificates of origin.

* * * * *

At the invitation of the Royal Horticultural Society, the Ninth International Horticultural Congress will be held in London from August 7 to August 15, 1930, immediately before the Fifth International Botanical Congress which is being held in Cambridge from August 16 to August 23.

**Ninth
International
Horticultural
Congress, 1930**

Details of the preliminary programme drawn up by the Society have recently been issued. The main subject for discussion at the Congress will be "Propagation, vegetative and seminal," and it is announced that a number of eminent British and foreign horticulturists have already signified their intention to present papers dealing with this question. The programme provides for papers and discussions on other subjects, for the holding of a flower show and for visits to research stations and gardens of horticultural interest throughout the United Kingdom.

All arrangements for the Congress are in the hands of the Royal Horticultural Society, and correspondence should be addressed to the Secretary at the Society's Offices, Vincent Square, London, S.W. 1.

* * * * *

New Regulations under the Agricultural Produce (Grading and Marking) Act, 1928, (Agricultural Produce (Grading and Marking) (Apples and Pears) Regulations, 1929) giving effect to certain minor amendments which have been proposed in connexion with the National Mark scheme for apples and pears, are under consideration. Briefly, the amendments modify the definitions in respect of size and colour for certain grades. The new Regulations will be in substitution for and revoke the Regulations made last year.

**Agricultural
Produce
(Grading and
Marking) Act**

Copies of the draft regulations are obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, or through any bookseller, price 1d., postage extra.

RECONDITIONING OF RURAL WORKERS' COTTAGES IN DEVON

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It is by now fairly well known that The Housing (Rural Workers) Act, 1926, was passed with the object of securing, with the help of grants from County Councils (of which the Government defray a half), the reconditioning of old houses occupied by agricultural and other country workers in such a way as to bring these dwellings up to modern standards of comfort and sanitation.

Unhealthy Rural Dwellings.—According to the latest available returns it appears that greater advantage has been taken of this Act in Devon than in any other county in England and Wales. This may possibly be due to the greater need of the Act in Devon than in the other counties, as one is well aware that a large number of houses occupied by farm workers have been reported upon annually by the Health Authorities as “not being in all respects reasonably fit for human habitation”—the standard required to-day being, of course, considerably higher than it was a few years since.

Probably, however, it will be found that a similar state of affairs exists in most other rural counties, but it cannot be gainsaid that the spending of large sums of money upon the reconditioning of cottages bringing in rents of from 2s. to 4s. per week is a very uneconomic proposition for the landlord—be he wealthy landowner or struggling farmer.

For several years before the passing of the 1926 Act, Local Sanitary Authorities, being fully aware of the heavy cost of upkeep of these rural cottages, and having in mind the acute shortage of houses in the country generally, were reluctant to enforce their powers rigidly under the Housing and Public Health Acts relating to insanitary dwellings. Had they done so, many of these cottages would have gone out of occupation and become derelict, or there would have been imposed upon the owners very heavy expense in the way of repairs, sanitation and the like. With the passing of the Rural Workers Act, these difficulties should disappear.

Scope of the Act.—Assistance is available for structural alteration, repair of or addition to dwellings, the provision of new roofs, water supply, drainage or sanitary conveniences or other like works, and for the conversion into dwellings of

buildings not previously used for that purpose. It is not available for ordinary repairs or upkeep except in so far as this is incidental to work which may be assisted.

The value of the dwelling after the completion of the proposed works, as estimated by the Local Authority, must not exceed £400. In computing the value "after completion" regard is had to the restrictions as to occupation and rental. No assistance is available if the estimated cost of the works proposed to be carried out is less than £50.

Grants.—The grant is not to exceed £100 per dwelling or be more than two-thirds of the estimated cost of works in respect of which the grant is given. The following conditions apply for 20 years after the completion of the works :—

- (a) The dwelling must be occupied by a person (whether as owner or tenant) who would not ordinarily pay a higher rent than that paid by agricultural workers in the district ; and
- (b) the rent must not be more than the ordinary agricultural rent, or the average rent paid during the previous five years with the addition of 3 per cent. on that part of the cost of works not covered by the grant.

If these conditions are not observed, the grant has to be repaid at compound interest. No regard is had to the financial standing of the applicant.

No assistance is given in respect of the cost of work which is commenced before the written approval of the County Council has been given thereto.

Loans.—The loan period is 20 years and the rate of interest $5\frac{1}{4}$ per cent. (or such other rate as may be fixed by the Minister of Health from time to time). Advances are made upon a first mortgage of the dwelling and may amount to as much as 90 per cent. of the value of the dwelling after completion of the works.

Assistance may be given either by grant or by loan, or both. It is important to note that if a loan only is given, the restrictions as to occupation, rent, etc., do not apply.

The Devon Scheme.—The original scheme of the Devon County Council, which was approved by the Ministry of Health in June, 1927, provided for the improvement of some 200 dwellings. Already, however, to April, 1929, over 360 applications have been received, and schemes affecting 170 dwellings have been definitely approved, involving payment of grants amounting to approximately £16,000. The average cost of the work to be carried out under these approved schemes amounts to approximately £192 per dwelling, and



FIG. 1. A farm workers' cottage before re-conditioning. Typical of many dwellings in process of reconstruction under the Housing (Rural Workers) Act.



FIG. 2.—A country cottage after reconditioning under the Act. All the work was carried out by the owner—an agricultural labourer.



FIG. 3. Formerly a brick-built stable with galvanized iron roof. Converted into two good cottages.



FIG. 4.—Cottage (possessing archaeological interest) before reconditioning. The owner desired to remove the bay and thatched roof, but has been requested to submit revised scheme so that these picturesque features may be retained.



FIG. 5. -A "Complete and satisfactory improvement." This farm workers' cottage, previously used as root store and calves house, was in a derelict state before



FIG. 6.- A reconditioned cottage in a South Devon fishing village.



FIG. 7. Two cottages reconstructed from the ruins of three old cottages



FIG. 8. Three farm workers' cottages. Formerly cob and thatch in bad repair.

the average grant £94 per dwelling. More than 90 per cent. of the schemes have earned the maximum grant.

Fig. 1 illustrates the type of cottage in respect of which applications for assistance have been received. The scheme for the improvement of this particular cottage (occupied by seven persons at the time the photograph was taken), includes the provision of a new roof, additional bedroom, scullery, washhouse, drainage, and water supply.

A considerable number of applicants have been owner-occupiers and have carried through schemes for improving their cottages very satisfactorily. Fig. 2 is an example of such a cottage. The owner, an agricultural labourer, purchased the cottage in a dilapidated condition and himself carried out the entire work of reconditioning, also the sinking of a 65-ft. well.

A number of buildings, including stables, barns, outbuildings, stores, etc., not previously used as dwellings, have been converted into cottages. Fig. 3 shows what was once a stable now converted into two useful cottages.

At the outset of the scheme, the County Council, with the approval of the District Councils, decided to enlist the help of the local Sanitary Officers, who possess first-hand knowledge of local properties and housing conditions. A conference was held between these officers and the members of the responsible Committee of the County Council and their officers; the proposals for working the Act were fully explained; and it was agreed that the Sanitary Officers should assist applicants, if desired, in preparing their schemes and supervising the works during progress. This arrangement is working well. The Sanitary Officer, with the consent of his District Council, receives a fee of £2 from the County Council in respect of each dwelling satisfactorily completed.

Each applicant is required to submit a scheme, on a form prepared and supplied by the County Council, setting out his proposals, together with a plan and detailed estimate of the cost. It was found that very few schemes as originally submitted could be accepted in their entirety. Very often only the crudest drawings and a "lump sum" estimate of the cost were forwarded, and had necessarily to be returned for further details or amendment. To facilitate the approval of schemes the Committee decided that where a proper plan, specification, and estimate prepared by an architect or surveyor were submitted, a reasonable fee therefor could be included in the estimate and would rank for grant.

All applications are forwarded to the Clerk of the County Council, who undertakes all correspondence with applicants. The plans and specifications are duplicated in the County Architect's department, and copies are forwarded to the local Sanitary Officers for use in connexion with the supervision of works. The original plans and specifications are returned to the owner.

The County Architect, in company with the County Medical Officer, visits and inspects each dwelling, and his report is considered by the Special Sub-Committee (of which the Rt. Hon. Sir Francis Acland is Chairman) at their monthly meetings. The schemes are at first approved in principle, and helpful suggestions are made for their betterment and as to the best means of carrying out the proposed works. When all is in order, a Certificate of Approval is issued.

From four to six months are usually allowed for completion of the works, but reasonable extension is invariably granted if applied for.

Building Requirements.—As a general rule, the Committee require that every cottage shall have (*inter alia*):—

- (1) A properly lighted and ventilated food storage.
- (2) A proper washhouse and furnace pan.
- (3) Three adequately ventilated bedrooms (not insisted upon where two large bedrooms are available).
- (4) A suitable water-supply—wells rendered safe from surface pollution and fitted with pump. (Except in special circumstances, and subject to stringent conditions, rainwater is not accepted as suitable for drinking or culinary purposes, nor, except as a supplementary supply, is it accepted for flushing purposes unless storage capacity is ample.)
- (5) A separate W.C. or E.C. properly lighted and ventilated.
- (6) Washing-up sink (*not* in the living room).
- (7) Slating laid to a 4-in. lap (asbestos slating, if used, to be blue to harmonize with the surrounding countryside).
- (8) All bare cob walls protected by means of plastering, finished "rough-cast" or "stucco."
- (9) Concrete or other approved paving around all external doors.
- (10) All necessary repairs carried out.

Special circumstances at times necessarily call for relaxation in some particulars, and such cases, when represented, have received sympathetic consideration.

Upon making final inspections, it has been found that the requirement as to repairs and renovations, which do not in themselves rank for grant, was in many cases either lightly regarded or ignored altogether. In issuing their Certificates of Approval, the Committee now draw particular attention to the clause dealing with the general repairs and renovations—

their approval of the scheme being conditional upon all necessary work of this nature being carried out.

Refusals and Withdrawals.—Of the 360 applications received, some 30 have been withdrawn and 52 refused. The withdrawals were mainly due to applicants not desiring to incur the expense involved by the requirements of the Committee. In most of these instances, however, ordinary repairs to render the dwellings more habitable have been put in hand by the owners without assistance from the Act.

In the case of most of the 52 applications rejected, the refusal was due to the premises being beyond satisfactory repair, while in others it was because the work had been commenced before the application was received or approved. In a few cases refusal was due to the bad situation of the dwellings. Local Authorities are specially directed by the Ministry of Health to reject applications where it appears to them that the house or building in respect of which the works are to be executed cannot, by reason of the narrowness, closeness or bad arrangement or condition of the streets or buildings in the immediate neighbourhood thereof, be converted into a dwelling or dwellings which is or are in all respects satisfactory.

Many would-be applicants were under the impression that if assistance were given, it would preclude the sale of the premises during the 20-year period during which the special conditions as to occupation, rent, etc., apply. This is quite erroneous. There is no restriction upon the sale of any dwelling in respect of which grant has been given, but the conditions, being attached to the dwelling itself, remain applicable for the 20 years whether or not the dwelling changes hands in the meantime.

Cottages of Architectural Interest.—Assistance cannot be given in any case in which the proposed works are likely to destroy or seriously diminish any historical, architectural or artistic interest attached to the dwelling. When considering applications in detail, care is taken to make such requirements as will prevent the disfigurement of such buildings so as to secure, as far as possible, that the special character and beauty of these dwellings, and fitness for their surroundings, is maintained. To assist in this purpose, the Council for the Preservation of Rural England, in conjunction with the Royal Institute of British Architects, have set up panels covering all parts of England and Wales, these panels being available for giving advice to owners who want the best technical assistance

in improving their cottages without spoiling their appearance. No charge is made for such advice, but applicants are expected to defray any travelling expenses which may be incurred.

Fig. 4 is an illustration of a cottage possessing archæological interest. The proposals for reconditioning, as submitted by the applicant, would, if carried out, alter the character of the house and detract from its value and picturesqueness. The owner was advised to submit an amended scheme after consultation with the local panel of architects.

With reference to the care taken to preserve, as far as possible, the picturesque character and type of cottages reconstructed, one may recall that in his appeal some while since for the preservation of ancient cottages the Prime Minister (the Rt. Hon. Stanley Baldwin, M.P.) observed that "nothing is more characteristic of England's countryside than the cottage homes which, for century upon century, have sheltered her sturdy sons of toil. . . . Ought we not, then, to be proud of them, to protect them, to do everything in our power to save them from decay?"

Fig. 5 is a study that, in the opinion of the Committee, has provided at reasonable cost a complete and satisfactory scheme of improvement, preserving withal the picturesque features of the cottage. The premises were previously used partly as a store for roots and as a calves' house. It is now the home of a farm worker.

Fig. 6 is a further example of a cottage which has been preserved in its original design. Figs. 7 and 8 illustrate other cottages reprieved from complete ruin and set up for a further lease of life.

Publicity.—Adequate action has been taken by the Committee to ensure that the scheme shall be brought to the knowledge of all persons likely to be interested. Local District Councils and their officers have been supplied with the fullest information as to the procedure for obtaining assistance and submitting schemes. Leaflets which briefly set out the provisions of the Act have been sent to all farmers (some 11,000 odd), landowners, solicitors, architects, estate agents and surveyors, as well as to all the parish councils in the county. Small posters, advertising the Act, have been placed in the country market places and in every village police station. A report of the monthly meetings of the Sub-Committee invariably finds its way into the local Press. It might be remarked that the county has been fairly thoroughly "dosed" with the news of the "tonic" contained in the Act.

Results of the Act.—The Act has certainly presented Local Authorities with a great opportunity for an intensive campaign against bad rural housing. It marks the dawn of a new and brighter era in the housing conditions of the rural worker, and has provided the means whereby the ancient and uneconomic policy of condemnation and demolition can be superseded by a modern and convenient method of preservation and reconstruction.

It is early yet to express an opinion as to whether the anticipated results with regard to the country as a whole have been all that was desired. In Devon, it can fairly be claimed that the results have so far come well up to expectation. This has been accomplished without undue cost to the ratepayers, for not a single additional official has been engaged specially to deal with the flow of work the scheme has entailed.

Provided the present rate of progress is maintained, the expenditure on grants will amount to approximately £50,000. *This sum represents a charge upon the County Rate of less than one-sixth of a penny in the £ for 20 years.*

The number of dwellings completed to date may seem a mere "drop in the ocean," but when the examples of the good that has actually been accomplished become more widely known, a heavy and continuous flow of applications may be expected.

Many of the reconstructed houses are situated in very remote parts of the county, where the activities of the Rural District Councils under the General Housing Acts—so far as they relate to the provision of new dwellings—have not yet penetrated. Tenants of these reconditioned dwellings have naturally expressed themselves as delighted with the improvements effected.

One always has in mind that the main object of the Act is to benefit the agricultural tenant by giving him and his family a decent house to live in at a low rental, with the necessary amenities of good water supply, sanitary and other household conveniences, that are commonplace in practically all urban dwellings.

The average rent charged in respect of the first 50 cottages completed in Devon works out at slightly less than 3s. 4d. per week. In no sense, therefore, can it be maintained that the owners of these cottages are being unduly subsidized. A signed statement has to be obtained annually that the conditions as to occupation and rent continue to be complied with.

The latest date for the receipt of applications is October 1, 1931. From experience gained in Devon, however, it is clear that all the good work that could be done will not have been accomplished by that date. Many Local Authorities have not yet realized the possibilities of the Act, whilst the schemes of other Authorities which should now be in full progress are still in a state of embryo.

Is it too much to hope that Parliament in its wisdom will extend the operation of this praiseworthy and beneficial Act ?

* * * * *

THE ALTERNATE HUSBANDRY: A LESSON FROM HISTORY

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THE authority of established practice, nowhere more firmly grounded than in the agricultural community, has continually been questioned by writers and theorists, or practical men who differed from their neighbours on the best methods to employ. Improvements of all kinds have been made in the passing centuries, but only at exceptional periods and in isolated instances have the necessary changes demanded by immediate circumstances been made sufficiently quickly. When an antipathy to change, readily understood because of the nature of farming operations, is general, it must be difficult for those who are using an improved method to believe that that improvement in its turn can be bettered in the face of adverse circumstances. The Norfolk four-course system, growing, as it did, out of the introduction of new crops, the turnip and clover in the late seventeenth and early eighteenth centuries, has now become so firmly established a tradition that it seems incredible that it could be changed with any advantage to the farmers in the eastern counties. Let us, however, examine the circumstances in which this system grew and flourished, and let us see what manner of reception it had from those who were known as "improvers" in the eighteenth century, and what were the practical alternatives to its adoption.

During the whole of the eighteenth century the demand for wheat was steadily increasing, and farmers were doing their utmost to cope with the demands of a population which was not only growing rapidly, but whose taste for wheaten flour was increasing equally rapidly. During the century the population doubled, and the increase was more pronounced

in the third and greatest in the last quarter of the century : moreover, a larger proportion of the people were eating bread made of wheat alone at the end of the century than at the beginning. Imports of wheat were practically negligible until the turn of the century.¹ All these circumstances made it profitable to grow wheat in this country, and the inclosures were mainly directed towards increasing the wheat acreage and introducing improved rotations that would enable wheat to be sown more frequently and with a prospect of improved yields.

In the eastern counties the change was very marked, because it was here that the earliest turnips were sown and the greatest advantage taken of the red clover crop introduced from Flanders in the seventeenth century. "For thirty years," says Arthur Young, "from 1730 to 1760, the great improvements in the north-west of the county (Norfolk) took place, which rendered the county in general famous."²

What were these improvements? Were they directed towards the establishment of the four-course system? We read in Thomas Hitts' *Treatise on Husbandry; or the Improvement of dry and barren lands*³ that "Barley may be sown on denshired land which will produce plentiful crops of corn and clover for three to four years and be in rich order for grass," while, on the following page, he says that Rockliff ploughs are used for paring in Lincolnshire. The process of denshiring was to pare off the turf with a breast plough, to allow the turves to dry and then burn them and scatter the ashes for manure; it was common to heath and fen land in many parts of the country. This system of paring and burning heathy land and taking several crops afterwards, either letting the land fall down, or sowing grass,

¹ See Ernlé: *English Farming, Past and Present*.—The yearly average imports were as follow :—

1765-74	..	..	53,000	quarters.
1775-84	..	..	60,000	"
1785-94	..	..	71,000	"
1795-04	..	..	615,000	"
1805-14	..	..	577,000	"

The highest of these figures represents about one-tenth of the annual consumption estimated by contemporaries. Until the "sixties" there had been a small exportable surplus, although the influence of the bounty on exports may have caused export when there was no true surplus.

² County Report, *Norfolk*, 1804, p. 31.

³ 1760, p. 126.

was customary in Kent at this time ⁴; it was also followed on the High Wolds of Yorkshire.⁵

This was, of course, some years before Coke of Norfolk began the work at Holkham for which he is so justly famous, and which is supposed to date from 1778: one of his first improvements was to abandon the local custom of three white crops in succession, and to take only two, keeping the land in grass for the two following years⁶. It would, therefore, seem that in the eastern counties, whose agriculture Young was so fond of placing before the country as a pattern of excellence, the four-course system, however general, was not universal.

Young himself, writing reports on the agriculture of Suffolk (1797), Lincolnshire (1799) and Norfolk (1804), for the old Board of Agriculture, gives a multitude of rotations, which were observed by the farmers of that time. He even goes so far as to say of one farmer in Norfolk that he was using "the old four-shift."⁷ The occurrence of 2-year leys is noted in this county as common in the rotations at Knattishall and Snetterton; at Eggmore and South Walsham, where a mixture of white clover, trefoil and rye grass was sown; at Oxnead, where the course had included 2-year leys in a six-course rotation since 1773, and was common throughout the country; at Thurning, he thinks the course would be improved if the 2-year ley were left down for an extra year; and, at Summerfield, Mr. Dursfield, who farmed 1,050 acres, had 2-year leys in those fields where he did not use 3-year.⁸ It is true that Young admits that, on the stronger land, the ley did not figure so largely,⁹ but he notes that one Drosier of Rudham, thinks that the greatest improvement would be to lay the land down for 8 to 10 years to repose the land from turnips and corn,¹⁰ and that Overman includes 3-year leys and 2-year leys in his courses. In Suffolk the poor sand lands were sown with trefoil and rye grass and left down from two to four years after turnips and barley, while the bad farmers are reproved for being in too great a hurry for corn and an immediate advantage (wheat was bringing very high prices in the war years) which caused them to plough too

⁴ John Mordant: *The Complete Steward*, 1761, p. 141.

⁵ G. Hunter: *Georgical Essays*, 1770, I. 196 ff.

⁶ A. M. W. Stirling: *Coke of Norfolk and his friends*, 1912, p. 158.
Earl Spencer: *Jour. R.A.S.E.*, Vol. III, 1842, p. 3.

⁷ County Report, p. 210.

⁸ *id.* pp. 194-201.

⁹ *id.* p. 212 ff.

¹⁰ *id.* p. 195.

soon. In the Fens it was common to pare and burn, to take oats twice, and leave the land in grass for 6 or 7 years, then repeating the process.¹¹

The same incidence of two-, three- or four-year leys is noted in Lincolnshire,¹² and it was not only in practice, but also in the writings of the "book farmers" that this system was advised at that time. Robert Brown, of Markle in Haddingtonshire, a well known farmer and writer, goes so far as to quote and applaud the justness of the views of Blyth on the subject. This is the more surprising as Blyth was writing about 1650, or some 160 years before Brown's *Treatise on Rural Affairs* appeared. Brown has nothing but approval for Blyth's view that land should not be kept too long in pasture, especially heavy, wet land, but should be "renovated with tillage, and after being cropped five or six years, sown down with grass seeds. . . ." "On the other hand," he adds, "Mr. Blyth appears to have possessed an accurate notion of the evils flowing from over-ploughing, or in other words, from keeping land too constantly under tillage, a system too prevalent, even now, in many English counties."¹³

The alternate husbandry had been in existence alongside the two- or three-crop and fallow system of the common fields for a very long time in many parts of England. It was the practice on "clay or light mould inclosures" and on temporarily inclosed heath land in Staffordshire in 1686,¹⁴ and was used on the downs of Wiltshire, and in the inclosures of Stafford, Leicester and Northampton in 1726.¹⁵ A 2-year ley was also recommended as desirable in newly broken up "sward" at the same time.¹⁶ At Ryhope, near Sunderland, also, leys of 5 or 6 years are recorded by George Bailey.¹⁷

At Holkham, as we have seen, Coke of Norfolk had introduced a system of 2-year leys; we learn that by 1850 the four-course rotation was followed throughout the district; that on the heavy lands in Suffolk the course prescribed by the leases was the four-field, and that the same was true of West Norfolk.¹⁸ In the latter district Caird discussed

¹¹ County Report, pp. 39-42.

¹² County Report, pp. 96-106.

¹³ *Treatise on Rural Affairs*: 1811, Vol. I, pp. 15 and 16.

¹⁴ Robert Plot: *The Natural History of Staffordshire*, pp. 107 and 108.

¹⁵ John Laurence: *A New System of Agriculture*, 1726, pp. 68 and 83.

¹⁶ *id.* p. 66. See also Thomas Hitt, *op. cit.*, p. 125.

¹⁷ *Annals of Agric.*, 1786, V., pp. 361-2.

¹⁸ James Caird: *English Agriculture in 1850-51*, pp. 153, 168 and 176.

with the most intelligent and experienced farmers the question of how far the system continued applicable, and found the general opinion to be that it was no longer necessary or expedient, because facilities for obtaining artificial manures were so much greater at that time than they had ever been. Where a man was not restricted by rigorous covenants, or farmed his own land, the system was departed from. Ten years before Caird made his survey, Barugh Almack had stated that while the four-course system was general in almost every part of the county, the marshes and fens were farmed on a different rotation, which "would be the case more generally if each person cultivated his own land."¹⁹ One farmer, Neave of Downham Grove, near Saxmundham, had even expressed the opinion that he would prefer to introduce a two-year ley into his rotation.²⁰

In Lincoln the 2-year ley had continued to find favour. Among many varied courses it was to be found on the Wolds, on the Heath and on the clay near Spilsby, while on the Carrs, the land was under the plough for a few years and then went back to grass. At the same time the four-course system was practised on many thousands of acres on the Wolds.²¹

It is doubtless easy to emphasize the divergencies from custom, but it is well to bring out the fact that the four-course system was largely imposed from above, and that even as late as the middle of the nineteenth century it had its critics. Economic changes brought about the extension of the system, which was regarded as the most approved form of husbandry.

The heavy land of Suffolk had been famous as dairy land for centuries. The cheese was not so good as Cheshire, but the butter was sent to London, and elsewhere and was generally commended. The dairy industry, however, fell on bad days: on the one hand, butter and cheese brought low prices because of the importation of Irish and Dutch products; on the other there was a difficulty in getting dairy servants. As a consequence the land was broken up, new leases were granted and the course of cropping thereafter varied but little over the county.²²

¹⁹ *On the Agriculture of Norfolk*: Jour. R.A.S.E., V., 1844, pp. 320-1.

²⁰ *id.* p. 332.

²¹ J. A. Clarke: *On the Farming of Lincolnshire*, Jour. R.A.S.E. XII (1851), pp. 332, 339, 347, 355, 330.

²² Wm. and Hugh Raynbird: *On the Agriculture of Suffolk*, 1849, pp. 7, 111, 117, 121, 124.

In the depression of the 'seventies and 'eighties of last century, however, large tracts of the heavier soils of East Anglia were sown down or fell down to grass, and corn-growing once more gave place largely to dairying. For some centuries before 1849 the heavy lands of Suffolk had been stocked with a native breed of cows (light dun polls) noted for high yields and butter qualities,²³ so that dairying in East Anglia is not the recent innovation for which Scotsmen and Cornishmen are generally given the credit.

In view of the important part now played by milk production throughout the whole of East Anglia it is somewhat difficult to account for the oft-repeated statement that, owing to the dryness of the climate, good grass fit for dairying cannot be produced in that region. Instances of successful pasture formation, both ancient and modern, are by no means rare. The climatic conditions do not differ appreciably from those of the north-east seaboard, where short term leys are the rule rather than the exception; and while, in the south, summer heat may be slightly more intense and spells of drought somewhat more protracted, the heavier, more retentive soils characteristic of East Anglia are less subject to drying-out. For mid-summer shortage, the southern farmer enjoys a peculiar advantage in lucerne.

It is true that unimproved or impoverished pasture is of little account for dairying. That applies universally. The heavy soils of the region in question, however, provided they are not waterlogged, respond generously to dressings of readily available phosphate. Pastures, everywhere, lose in feeding value when parched, and, in such an event, nothing so well maintains milk yield as supplementary green keep.

Some of the methods practised about the middle of last century closely resemble those recommended to-day. In 1864 H. S. Thompson described²⁴ his own method of dealing with a poor, clay land farm. Having convinced himself that corn-growing alone would not pay, he had recourse to sheep. His plan was to buy in ewes in the autumn to run on the old grassland through the winter at the rate of about one to the acre. In ordinary seasons they maintained themselves without extra keep till Christmas, from which time they received a small feed of oats daily until lambing time. After lambing, turnips and mangolds, previously

²³ Raynbird, *op. cit.*

²⁴ Jour. Roy. Agric. Soc., 1864.

stored on the grass, were given them with corn or cake until the winter tares or clover was ready. Rape followed and, by continuing the corn or cake, all the lambs and most of the ewes were sold fat in time for the land to be prepared for wheat. From an average yield of 2 to 3 qr. he states that the wheat crop soon rose to 4 and even 5 qr. and the spring corn improved in proportion.

He records that the farm contained no grass good enough to fatten a bullock. "The previous plan had been to buy in young cattle in the spring, when most other graziers were doing the same, and when, consequently, in 9 years out of 10 they were bought dear. They had to be sold out again in the autumn when many other farmers were selling too; so that the tenant generally returned from the fair grumbling that he had scarcely got more than he gave for his stock and that his summer grass was all but thrown away." As an alternative, caking on grass was tried but without success. Thereupon, he bought yearling heifers in May and a young bull to run with them at grass. The bull was taken away in August and the heifers remained in the pastures until severe weather set in, when they were taken into a strawyard and given, once a day, a feed of roots "if there were any to spare": if not, 2 lb. of linseed cake daily. If in-calf heifers were very dear in the spring, he sometimes sold a few before calving for as much money as if they were prime fat: but the usual course was to let the calves run with their dams all the summer. When taken up in October, the calves were so fat "they looked like prize beasts in miniature." After keeping them well through the winter, "they were eagerly bought by the butchers in June when the winter-fed cattle had been nearly all slaughtered and the grass-fed had not yet come in." As for the heifers, a few that promised to be first-rate milkers were taken into the dairy; the greater part were sold for winter feeding and realized about £2 more than when bought eighteen months before. The calves generally realized £1 per month of age: one year, the whole lot averaged £16 each at 14 months. Is this another case of history repeating itself?

As regards sheep, the trend nowadays is towards free-range rather than folding, so that grass would take the place of summer folding crops. For grazing, new leys may have several advantages over permanent grass. They start growth earlier in spring and generally respond more quickly to forcing treatment: they are often superior in feeding value.

Thus they are well adapted for the production of fat lamb at about 14 weeks old. They may be grazed by ewes and lambs until the end of May and thereupon shut up for a leafy hay crop or, in suitable circumstances, for the harvesting of a crop of wild white clover seed. It is now generally recognized that genuine "once-grown" wild white is little, if any, inferior to seed off old, permanent pasture. What is, perhaps, less widely realized is the high feeding value of well-made leafy hay, and the part it can play in the replacement of costly feeding stuffs. After the removal of the hay or seed crop, the aftermath will quickly respond to rain and provide abundant leafy keep throughout the autumn and well into winter.

It is not suggested that this is the only way of exploiting a climate subject to spells of summer drought: it is, however, a method favourable to the spread and development of wild white clover, a plant constituting one of the best safeguards against drying-out and, perhaps, the most effective agent for increasing the fertility of arable land.

As an alternative, intermittent grazing may be suggested whereby a higher total yield will be obtained than under continuous defoliation, with its attendant risk of shortage should the entire pasture be caught bare when a dry spell sets in.

The general effect of increasing the proportion of grass on an arable farm is to diminish costs. Just as eggs, when danger threatens, are safer in several small baskets than in a single large one, so variety in a farming crisis is a safeguard against total loss. It is unnecessary to elaborate means of utilization or to discuss fully whether the grass shall be permanent or temporary. These things depend upon individual circumstances. Where, however, a principal object is the production of crops for sale, the temporary ley working round the farm, gathering fertility as it goes, is generally to be preferred. Questions, however, of water supply and fencing may sometimes determine otherwise. Our primary and main object is to show that modern seeds-mixtures sown under suitable conditions should not be ruled out as a possible means for mitigating the present stress even in the somewhat peculiar circumstances of East Anglia.

MOLE DRAINING BY DIRECT TRACTOR HAULAGE

IN the five years which have elapsed since the first demonstration of tractor-drawn mole drainers was carried out in an orchard in Devonshire, some 37 such demonstrations have been held in 24 counties in England and Wales. They have been organized by the County Authorities acting in conjunction with the Ministry, and in every case the Ministry's Machinery Officer, Mr. Thompson Close, has been in charge of the actual draining operations on the day of the demonstration. The demonstrations were widely advertised, so as to bring them to the notice of as large a circle of agriculturists as possible.

Those years have been marked by great improvements, both in tractors and in the mole drainers themselves. At the beginning of the period, light tractors only were available, and they were not always provided with strakes well enough designed to afford adequate adhesion on wet and slippery surfaces such as are commonly presented in the fields in the months of October to May when mole draining can most conveniently be carried out. As a consequence their effective hauling power was generally insufficient. They were not equal to drawing mole drains at a greater average depth than 15 inches, and it is only in cases where circumstances are specially favourable that that depth can be relied on to ensure that the drains will last. There are now on the market, however, two or three makes of tractor, gear driven, with good wheel adhesion, which give power enough to draw mole drains at depths down to 21 inches and with a bore of $2\frac{1}{2}$ or 3 inches.

Mole drainers, too, have been improved. In the early days they were fitted with a rough coulter in advance of the blade carrying the cartridge, which tended to tear the turf and to leave a gaping cut which resulted in some cases in the early silting of the drains. This type of coulter has now been replaced by a disc, which makes a clean cut. The danger of silting is minimized and at the same time the rate of working is speeded up. Whereas in the first demonstrations only two types of drainer were shown, there were to be seen at the demonstration carried out last year some ten or a dozen effective implements of different types.

Notwithstanding the inadequacy of the implements available the work performed at the demonstrations carried out

in 1924 was in a number of cases quite satisfactory—and it must not be forgotten that in many cases the work was done in circumstances where it would not normally have been carried out. The programme of demonstrations had to be carried through, the important thing being to show the system, the desirability of the drains being a secondary matter. Some account of the work was given in an article which appeared in this JOURNAL in October, 1926, and, since the dates of the reports to which reference is there made, further reports have been received from the Ministry's Inspectors showing that the good results have been maintained. Thus, of the orchard where the first demonstration of all took place on February 18, 1924, at Cullompton in Devonshire, a report made late in December, 1927, states that the land was then comparatively dry. The farmer himself said that in similar weather conditions to those prevailing at the time of the visit the field would before draining have been inches deep in water. The work had been successful, and the farmer had secured all the possible good effects by piping the ends of the moles, keeping the main drains clear and providing a brick and concrete outfall. Mr. Thompson Close visited the orchard in the autumn of 1928, and found the drains still working well. He expressed the view, however, that they were nearing the end of their useful life, having been drawn too shallow with a light tractor—and that the work might now well be done over again. He was of the same opinion regarding the other three fields on which demonstrations were held in the spring of 1924. Even so, of the field near Sherborne in Dorset, which in December, 1927, was stated to be beginning to deteriorate, he reported that improvement was still evident and that sheep were still being grazed there. With regard to the field at Bushton, Wilts, he reported that in spite of the drains having been drawn too shallow the field was much improved. The fact that the occupier had taken the trouble to keep clear the ends of the moles, some of which he had piped, no doubt helped to maintain the good effect of the work. Some improvement was noted too on the field at Marshwood in Dorset.

Season 1924-25.—By the time the 1924-25 mole draining season opened the Ministry had been able to make arrangements for the use of a gear-driven tractor with improved strakes, but still only two types of mole drain plough were available.

The autumn demonstrations were carried out under difficult circumstances. One was on a stubble field at North Stoke,

Kesteven, which was so waterlogged that the tractors could not get sufficient grip, and another on a field at Horsington, Somerset, in which the fall was too slight to allow the water to get away quickly enough. Again, at the demonstration at Brentwood, Essex, in November, the ground was so spongy that the tractors cut in deeply, and it was not anticipated that lasting results would be obtained. Nevertheless in this case the drains continued to function, and a report of November 11, 1927, states that the main outfall was then running freely.

In the winter of 1924 and the spring of 1925, weather conditions improved and a number of very satisfactory results are to be recorded. At Cockle Park (January 30, 1924) the improvement described in the JOURNAL article of October, 1926, had, according to a report of December 21, 1927, been well maintained. On the drained portion of the field, standing water had disappeared from the furrows; the land was sounder, and rushes and tussocks had gone. The site of the Cumberland demonstration was visited by Mr. Close in the autumn of 1928, and he then confirmed the good reports which had already been received in May, 1926, and December, 1927. The owner was well pleased with the results of the work done. Mr. Close also visited the farm at Great Smeaton near Northallerton, where a certain acreage had been drained in February, 1925. He reported that, although the work had been done when snow was lying on the ground, the drains had proved to be satisfactory. The herbage was of better quality and the field generally had been improved. Drainage outfits had recently been purchased by farmers in the neighbourhood.

Of the field near Windsor on which a demonstration was held in March, 1925, a report made in January, 1928, states that the improvement previously recorded had been maintained. Satisfactory reports were also received on the work done at the Cheshire School of Agriculture, Reaseheath, in December, 1924.

In certain cases no very marked improvement has occurred as a result of these mole draining operations, and some of the reasons have already been indicated above. Another important cause of failure exists, however, and it is well brought out in the report made in December, 1927, on the work done at Holsworthy, Devon, in April, 1925, which runs as follows: "On the whole I am inclined to think that this field has been slightly improved, but the improvement has not been maintained because the farmer has never completed the main drain nor piped the ends of the moles."

The failures at Aberystwyth and at Tiverton, and the reasons for these failures, were dealt with in the JOURNAL article previously mentioned.

Season 1925-26.—The demonstrations of the season 1925-26 were carried through with the same tractors and mole draining ploughs as in the previous season. The good results obtained at Purbrook, near Cosham, Hants, were reported on November 28, 1927, to have been maintained, and a report was received also in the winter of 1927 showing that the work done at the Seale Hayne Agricultural College had given good results.

The demonstration near Winslow, Bucks, in January, 1926, was attended with satisfactory results. It was reported in December, 1926, that the farmer had purchased a tractor mole drainer for his own use, and in January, 1928, he was reported as having drained most of his suitable land, and as doing contract work on neighbouring farms with his tackle. At the latter date, tussock grass was reported to have disappeared and the general quality of the keep to have improved. It was then possible to stock the field at any time, whereas, before the demonstration, it was generally useless until May in average seasons.

It is interesting to record that although in the JOURNAL article of October, 1926, the results of the demonstration at Witheridge, Devon, were stated to have been unsatisfactory, Mr. Close found, on his visit to that place in the autumn of 1928, that the drains had nevertheless continued to function and that the farmer was well pleased with what had been done.

Particular interest attaches, too, to the reports made in December, 1927, on farms at Binstead in the Isle of Wight and Cerne Abbas in Dorset, where demonstrations were held in 1925 in November and December, respectively. In respect of the former the report states : “ . . . much improved. The general condition of the fields would be materially improved if the ditch which runs along the bottom of each field was deepened and cleaned out.” Of the latter the report states the field shows improvement and that cattle show preference for it over others. It goes on “ . . . the outlets of the drains in the main ditch are not being looked after as well as might be. The character of the herbage has improved, but this would have been better if dressings of phosphates had been applied.”

Season 1926-27.—Six demonstrations were carried out in the first four months of 1927 at centres near Wootton Bassett, Wilts; Highnam, near Gloucester; Plumpton, near Lewes,

Sussex ; Ossington, near Newark, Notts ; Hutton, near Preston, Lancs ; and at St. Clears, Carmarthen.

The weather conditions were in all cases satisfactory, with the exception of the Highnam demonstration where heavy rain somewhat interfered with operations. Nevertheless the work was satisfactorily done at all the centres.

The number of mole drain ploughs available for demonstration had increased considerably since the previous season, and the tractors had been improved, both as regards the amount of power and as regards the straking of the wheels.

It was possible, therefore, without difficulty to draw the mole drains in all cases at a safe depth.

The reports which were received in the autumn of 1927 indicate that the work had resulted in all cases in an improvement of the land. In respect of the fields drained at Wootton Bassett it was, however, reported that the improvement which had been effected would probably have been more appreciable if greater care had been taken to keep the drains clear by piping the ends of the moles. Mr. Close was able to pay a visit to this centre in the autumn of 1928. He confirmed the fact that great improvement had taken place in the character of the herbage and the general condition of the land. He also noted that greater care might with advantage be taken to keep the drains open and clear. At the same time he reported that the farmer was so satisfied with the results of the work that he had purchased a high powered tractor for the purpose of draining a neighbouring grass farm which he had recently taken over. Mr. Close also reported, in the autumn of 1928, on the fields at Ossington and Highnam. Of the former, he said that the field showed a wonderful improvement and that the occupier was even rearing pheasants in the lower portion. In regard to the field at Highnam, he stated that it was perfectly dry, but he expressed the opinion that the drains would not have a long life as they are in soil such as is not usually considered quite stiff enough for the making of good mole drains.

Seasons 1927-28 and 1928-29.—Three demonstrations were held altogether in these two seasons, one in May, 1928, on a farm near Saxmundham, at which only a small number of implements was shown, and the others at Filleigh, in Devonshire, and Studley College (Warwickshire) in November and December, 1928, respectively. At these two demonstrations there was a very full display of all the latest types of tractors and implements. Not only were tractors of the straked wheel type demonstrated, but a track-laying tractor was also shown,

all giving adequate power and putting up a good performance. Among the implements used were some ten different types of mole drain plough, cable draining sets and ditch excavators.

These demonstrations were fully satisfactory from the educational point of view, a wide range of implements being shown and an excellent system of drains being drawn in every case. It is, however, doubtful whether the work at Filleigh will be lasting, on account of the nature of the soil.

It is yet too early to present any reports on the work carried out at these demonstrations, but the fields will be kept under observation, and the Ministry will arrange that reports on their condition will be made from time to time as in the case of all the sites of the mole-draining demonstrations of the past five years.

Conclusions.—Mole draining is no new practice. Implements constructed for haulage by horses, either direct or by means of a capstan and cable, were employed for many years, and steam cable outfits have been used for more than half a century. Their work has been lasting: but the use of the motor tractor for mole draining is a development of very recent times. The war led to the rapid development of the agricultural tractor, and it also left a legacy of much under-drained land. Labour costs and the prices of material had risen by the end of the war to such a point that it became utterly uneconomic in almost all cases to use the ordinary methods of pipe or even bush draining. Nothing could be more natural than that in the early post-war years an attempt should be made to use the tractor for drainage purposes. Mole ploughs for use with tractors were eventually produced, and now, after some five years of trial, tractors and drainers have been so developed that sufficient types have been evolved to make mole draining by this means an economic proposition under most conditions.

The mole draining demonstrations of the past five years have brought this method to the notice of agriculturists in all parts of the country.

The experience which has been gained during the course of those demonstrations indicates that the use on grassland of a tractor for the purpose of mole draining has, in itself, a salutary effect on the land. The wheel strakes disturb the surface and their action resembles that of the hoof cultivation of grazing animals. This has been clearly seen on many of the fields where mole draining has been done, fresh young herbage springing up where the wheels of the tractors have run.

The best time to mole drain is from October to May, when the land is fairly wet. The resistance to the plough is not high, the slits in the land made by the coulter seal up quickly and the full beneficial effect of the tractor wheels is obtained.

It has been found that the most satisfactory distance apart of the moles is about 9 ft. At this distance apart there are enough drains to ensure that all the surface water is easily and quickly carried away, and even if some of them are silted up, as sometimes happens if dry weather follows draining operations, it is unlikely that the whole drainage system will be ruined.

The drains should be drawn at least 3 to 4 in. below the top of the clay, and it is, of course, in clay soils chiefly that mole draining is usually effective. This depth may on grassland be as little as 12 in. from the surface, but in most cases it will vary from 16 to 21 in. according to the nature of the soil. At this depth mole drains may be expected to stand up even if haycarts and tractors pass over them frequently. On arable land the moles should be drawn somewhat deeper than on grassland.

Where a dyke exists in the field to be mole-drained, it should, if possible, be used as a main drain, provided that the ends of the moles are protected and the outlet of the dyke is kept open.

In this connexion it may be well to point out that the work of the Ministry's officials and of County Authorities was confined to demonstrating the use of the draining implements and to showing the best method of running the moles and main drains in order that the best drainage effect might be secured. The work could not in every case be completed—nor was it possible in any case for the authorities to supply the material required to pipe the ends of the moles or to complete the making of permanent main drains. This had to be left to the occupiers of the land used in the demonstrations. As is seen in a number of the reports quoted in this article it is to the omission of occupiers either properly to complete the work done during the demonstration, or to maintain the moles and main drains afterwards, that failure must in many of the cases be attributed. It is impossible to lay too much stress on the importance of this part of the work. The material required is small, the labour necessary is not great, but the efficiency of the drainage system is so much enhanced and its durability increased that it should in no circumstances be neglected.

This article is, as its title indicates, concerned mainly with mole drain ploughs drawn by direct tractor haulage, but it

would not be complete without a reference such as has already been made to the work of steam cable outfits. These outfits have been shown at many of the demonstrations. Their work is too well known to need further comment here. A word, however, must be added on the subject of the advance which has taken place in the other types of cable outfit. These were in the first instance operated by a capstan and horse gear, but this has now been superseded by a small petrol engine, geared down, mounted on a frame which can be moved to different parts of the field either by a horse or under its own power. There are two or three very efficient makes now on the market and a number of them are being used by contractors who are prepared to undertake mole drainage work. Such outfits have been used on the aerodromes of the Air Ministry.

Although only a recent development, mole draining by direct tractor haulage has now become a well-established practice. It may be expected to be one of the most important factors in the improvement of much of the hitherto unimproved grassland of the country.

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COMMON LUNG WORMS OF CATTLE, SHEEP AND GOATS

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The Disease and its Symptoms.—Parasitic worms in the tubes of the lungs, and in the lung substance itself, are frequently the cause of a more or less severe disease in cattle, sheep and goats. The name "Hoose" or "Husk" is commonly used for the condition because of the peculiar spasmodic husky cough which is one of its most prominent symptoms. It is scientifically called *Verminous bronchitis* or *Verminous pneumonia*; the former name is used where the tubes of the lung (bronchi) are attacked, and the latter where the lungs themselves become involved (Fig. 1).

Affected animals cough only occasionally in the early stages of the disease, but as they become more and more heavily infected through remaining on the same pasture, the cough occurs more frequently and becomes more distressing until, in the later stages, long paroxysms of coughing are seen, with distressed breathing and signs of suffocation. Animals may fall down through weakness during these spasms of coughing.

The presence of the worms in the tubes of the lung causes an irritation which results in the exudation of a slimy fluid (mucus) from the walls of the tubes. This is frequently

expectorated during the spasms of coughing, but as the strength of the animal decreases during the course of the disease, and more and more mucus is exuded by the bronchi, the task of keeping these breathing tubes clear becomes too great, and finally death results from suffocation.

As a result of the inflammation of bronchi and lungs and the great discomfort caused by it, "husky" animals fall off in condition with increasing rapidity, the appetite wanes, diarrhoea and foetid breath are usually observed, the coat is rough or fleece dry and unhealthy, and growth in young animals may cease. If nothing is done to remove the animals from the source of continual reinfection, death will frequently result in from two to five months after the first appearance of symptoms.

On making a post-mortem examination, the bronchi may be found blocked with frothy mucus in which the worms are situated, portions of the lung may be solid and liver-like, while in sheep some parts may present a nodular appearance, with greyish yellow areas up to an inch in diameter, and small dark spots on the lung surface.

Occurrence.—The two kinds of worm which cause verminous bronchitis occur in young cattle, sheep and goats, and are much less frequent in animals over twelve months old. The species of worm which inhabits the lung substance and causes verminous pneumonia does not occur in cattle, and is commoner in mature sheep and goats than in those less than twelve months old. It is, however, not unusual to see lambs infected with worms both in the bronchi and in the lungs. These diseases may be seen at any time during the year, but are most prevalent in the spring and summer months, and become increasingly severe towards the months of September and October. Damp pastures and crowded conditions of grazing favour their spread, reasons for all of which will be found in the account of the life history of the parasite.

Description of the Worms.—The lung worm of calves (Fig. 2) which has been called the "threadworm" is scientifically known as *Dictyocaulus viviparus*. It measures from $1\frac{1}{2}$ in. to $3\frac{1}{2}$ in. long, is white in colour, and very fine and thread-like. It is usually found in the medium-sized bronchi, and causes verminous bronchitis—pneumonia only occurring in the later stages as a secondary condition.

The common threadworm of sheep and goats is called *Dictyocaulus filaria*; it is a little larger than the threadworm of calves, measuring up to 4 in. in length, but its general



FIG. 1.
COMMON LUNG WORMS OF CATTLE, SHEEP AND GOATS.

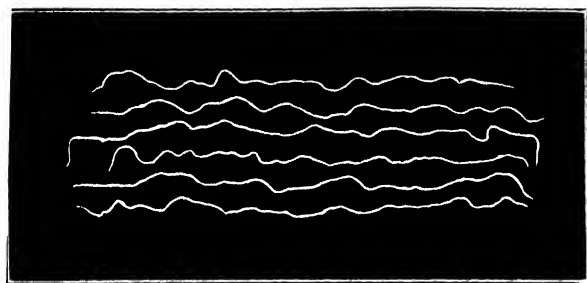


FIG. 2.

FIG. 1.--Sheep's lung showing exceptionally heavy infestation with thread worms. Part of the lung and the mucus surrounding the worms have been removed so that they may be seen in position in all the tubes of the lung.

FIG. 2.--The mature threadworms of calves--natural size.

appearance is the same. It also inhabits the medium-sized bronchi and causes verminous bronchitis.

There are two other species of worm also common in the lungs of sheep and goats, which have been called "hair lung-worms" (*Prostostrogylus rufescens* and *Prostostrogylus capillaria*). They occur at first in the very small bronchi, and afterwards in the lung substance, where they cause the nodules and greyish yellow areas previously mentioned; these, however, are not always present, the post-mortem examination may simply show large patches of solid lung of the consistency of liver. They cause verminous pneumonia, in which the spasmodic coughing symptoms are not so prominent, and frequently do not appear until the later stages of the disease. Difficulty in breathing is marked, and there is the same loss of appetite and falling away in condition as in the verminous bronchitis caused by thread worms.

Life History of the Worms.—*Threadworms.*—The adult threadworms live in the medium-sized bronchial tubes, where the females lay large numbers of eggs. Almost as soon as the eggs are laid they hatch, giving rise to minute larval worms (very young worms), these gradually finding their way from the bronchi to the wind pipe, and continuing upwards reach the back of the throat, their progress being assisted by coughing. Some are directly expelled in the frothy mucus during the spasms of coughing, but the majority are swallowed and finally reach the pastures, still alive, in the droppings. The larvæ (young worms) which are passed out with the droppings on to the ground have to remain there for a period varying between four days and two weeks or more before they are able to infect any animal which may pick them up while grazing. The duration of this period is dependent upon weather conditions, a certain amount of moisture and warmth being necessary to their development. Late spring and summer are therefore the most favourable times of the year, and damp low-lying pastures the best ground for them. During this period of development in the droppings or surrounding soil, the larvæ pass through a series of changes and moult their skins twice. After the second moult they do not completely cast off the old skin, but retain it as a protecting sheath over their own proper skin. In this stage they are very resistant to cold and drought, as well as to such substances as lime, salt or bluestone which may be applied to the land in an effort to kill them, and although the great majority will die if not picked up by a grazing animal of the right kind within twelve months, some few may remain alive for even longer periods.

During the night and on cloudy days these infective larvæ have the habit of climbing on to blades of grass in the dew or rain on their surface, but the majority as a rule descend again into the soil when exposed to direct sunlight. When such larvæ, which have completed the cycle of changes on the ground, are taken with the grass into the stomach of the grazing animal, their development continues, they reach the lungs—most probably carried there by the blood—and develop into adult worms.

Hair Lungworms.—The complete life history of the “hair lungworm” is not known. The adults inhabit the very small bronchial tubes and the substance of the lung, where the females lay large numbers of eggs. After egg-laying has ceased they work their way farther into the lung substance and cause the nodules previously mentioned. These nodules sometimes become infected with bacteria (germs), and abscesses may form. After the eggs are laid the larvæ soon appear and find their way to the pasture in a like manner to those of the “threadworm.” Nothing is known about their subsequent development, but it is probably similar to that of the “threadworms” above described.

Prevention.—To cause disease these worms must be present in large numbers. As will be understood from the account of the life history, their numbers cannot increase in the animals’ body, but every adult worm present in the lungs must have been taken in with the grass. Crowded conditions of pasturing are therefore carefully to be avoided, as under such conditions, not only are more larvæ dropped into every square yard of ground, but the chances for each individual larva being quickly picked up are greatly increased. A little less crowding may make all the difference.

Wet pastures favour the development and preservation of the infective larvæ and particular care must be observed in grazing these.

Pastures which are known to be infected should be grazed by older stock.

If the pastures are infected with sheep lungworms only, they may be grazed by cattle of any age, as lungworms of sheep cannot live in cattle. In a like manner pastures known to be infected only with cattle lungworms may be grazed by sheep of any age. In changing the kind of stock on a pasture in this way, it must not be overlooked that pasture favourable to the development of one kind of worm will also be favourable to the development of another, and if any kind of stock is kept

there under crowded conditions, worms will be sure to make their appearance before very long.

It is an excellent practice to change the kind of stock pasturing a piece of land from time to time, while mixed grazing is always greatly to be preferred over grazing with one kind of stock only. Mixed grazing insures that the particular species of worms which infects each kind of animal will be comparatively widely scattered over the pasture.

On moderately infested land it is a good plan to keep the animals indoors until the dew has dried. By this time the majority of the larvæ have descended from the grass blades, and the risk of infection, though not absolutely avoided, is considerably lightened.

Where land is badly infested, the only course to be taken is the removal of all susceptible animals for a period of not less than twelve months, during which time the majority of the larvæ will have perished.

Another point which should not be overlooked is the disposal of the manure from infected animals. Heat and fermentation, such as takes place in a heap of manure, kills the larvæ. Care should, therefore, be taken to see that all manure from places where infested animals have been housed at night has thoroughly heated before it is taken out to the fields; even then it is safer to reserve it for meadow or arable land.

Curative Treatment.—The injection of drugs into the wind pipe is considered by some to give good results. This form of treatment is extensively practised, but should be undertaken only by a qualified veterinary surgeon. Fumigation and chloroform inhalation are also reported to have given satisfactory results, but are dangerous to apply, and here again the services of a veterinary surgeon should be requisitioned.

It is popularly supposed that various volatile drugs, such as turpentine, which are in part excreted by the lungs, will, if administered by the mouth, kill the parasites during the process of excretion. These drugs are, however, excreted by the lungs in such small quantities as to be quite harmless to the parasites and the treatment is not effective.

None of the above-mentioned medicinal treatments has given much promise under experimental conditions, and the only sound course left open, where once the disease has made its appearance, is to feed and house the affected animals well, and to remove them from the infected pasture where they are continually picking up more worms. These measures will do a great deal towards insuring their final recovery.

THE CONTROL OF A SERIOUS POTATO TROUBLE

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FOR some years past, potato growers in Lincolnshire, Yorkshire, Lancashire and other counties in this country have suffered severe losses from an obscure complaint that has been variously called "Potato sickness," "Potato eelworm" and "Potato dab." The sum of the damage caused is often very great, for in bad cases the crop may be almost a complete failure, and, when lifted, may weigh no more than the seed planted. A further serious feature is that the trouble seems to preserve a high intensity once it becomes established in a field or garden, and it is not like certain specific diseases which vary within wide limits year after year. The complaint is found in its most virulent form, at least in Lincolnshire, in first and second early varieties, but late varieties may also be seriously affected. Fortunately, it has not, up to the present, become a serious menace to the growing of potatoes except in those districts where repeated cropping of the land with potatoes has been practised over a considerable number of years.

Concerning this complaint, little information has yet become available, and hitherto no treatment could be recommended with any certainty of success. To remedy this state of affairs, investigations on the cause and control of this trouble have now been added to the programme of work adopted by the Kirton Agricultural Institute. During the past season (1928), in addition to experimental work as to the cause of the trouble, comparative control trials of soil treatment by certain chemical substances were carried out by the writer, on a commercial scale, in a field on the Institute farm. The degree of control obtained by two of the chemicals employed was striking, and justifies the publication of the results; but it must be emphasized that the experiment is to be regarded as a preliminary one, and further extensive trials must be carried out under varying weather and soil conditions, before final conclusions can be arrived at.

Symptoms.—The trouble can easily be recognized, in the first instance, by the poor growth made by the plants in early summer; and, subsequently, by discoloration or yellowing of the foliage. The leaves of an affected plant remain mottled-green or yellow in colour and as a rule the apical margins of the leaflets gradually turn brown. As the leaves become older, this

scorching or browning becomes more pronounced; the margins of the leaflets become upwardly and inwardly rolled and finally the diseased leaves wilt and wither away. The symptoms usually appear first on the lower leaves of the plant and spread slowly but steadily upwards.

Affected plants may live for some time, but they rarely recover and the foliage finally turns brown and the plants die. When the haulm is thus destroyed, which may happen as early as the middle of June, further increase in size of the tubers is impossible, so that only a small yield is obtained.

The Cause of Failure of Potatoes in Potato-sick Land.—Much further research is needed to discover the nature of this crop failure and many problems connected with it await elucidation, as very little work has been done with regard to the cause and control of the disease. In all cases of failure examined by the writer in Lincolnshire, the roots and rhizomes (underground stems) have always borne large numbers of the cysts of the eelworm *Heterodera schachtii*, and the fungus *Corticium (Rhizoctonia) Solani* has also been present and equally common.

It was realized at the outset that full control of the trouble could not be hoped for until its exact cause was known. During the season of 1928, investigations were commenced to secure this information, if possible. The experiments were done in 12-inch earthenware flower pots. Five series, with six pots in each were used. The soil used, the same in all five series, was already heavily infested with both the eelworm *H. schachtii* and the fungus *C. Solani*, a potato crop having previously failed in it. In the first four series of pots alluded to in the table below, the soil was sterilized by means of steam under pressure in an autoclave so as to destroy all the eelworms and fungi present. A dressing of artificial manure at the rate of 15 cwt. to the acre was added to all the pots before planting. It was made up of three parts sulphate of ammonia, four parts superphosphate and two parts sulphate of potash. All the pots were planted with the variety Eclipse, this being the one about which complaints are most frequent. The sets were disinfected by immersion in 0.1 per cent. solution of mercuric chloride for 1½ hours before planting. Several inoculations were carried out as shown in the following table :—

No. of Series	Inoculum added to the soil at time of planting
I.—Sterilized soil	.. Untreated.
II.—Sterilized soil	.. The fungus— <i>Corticium Solani</i> .

- III.—Sterilized soil .. The eelworm—*Heterodera schachtii*.
IV.—Sterilized soil .. Both the fungus and eelworm (in amount equivalent to the sum of the previous two series).
V.—Non-sterilized soil .. Untreated.

The inoculation with *Corticium Solani* was made by adding sclerotia of the fungus from a culture on nutrient potato agar. The first inocula were stirred into the soil three days before the potatoes were planted, and the subsequent inocula were added about twelve days later. With *Heterodera schachtii*, approximately 2,600 cysts of the eelworm were introduced into each pot at the time of planting the potatoes.

All the pots were planted up on the same day, April 16, and they were then placed in the open, being carefully watered throughout the season in such a way as to approach field conditions as closely as possible.

The plants in Series I made normal growth throughout the growing period, and there was no trace of either eelworm or fungus on them. The plants in Series II and III showed normal growth for the first few weeks, but this was followed by a check in the growth rate which lasted over a period of about three weeks.

On examination it was found that most of the roots and the rhizomes of the plants in Series III were thickly covered with cysts of the eelworm *Heterodera schachtii*, and that the stems of those in Series II were badly attacked with the fungus *Corticium Solani*. After the check, or critical period, the plants in both these series made normal growth. One peculiar feature, occurring in all six pots, was that the check period where eelworms were concerned commenced about a week earlier than that which occurred when *Corticium* was present. In Series IV, after the first few weeks of normality, the check period continued throughout the life of the plant, and was similar to that which occurred in Series V. It was found that the plants in both these series were, as was to be expected, heavily infested with the eelworm cysts as well as with the fungus. In Series V, however, the stunted growth of the haulms and the characteristic symptoms of the disease were much more pronounced than in Series IV, and the plants died off early in the season, whilst those on all the other series remained more or less green.

It is possible that the marked difference in the appearance of the plants in Series IV and V was due to insufficient inoculation in the former, as it was discovered later that the

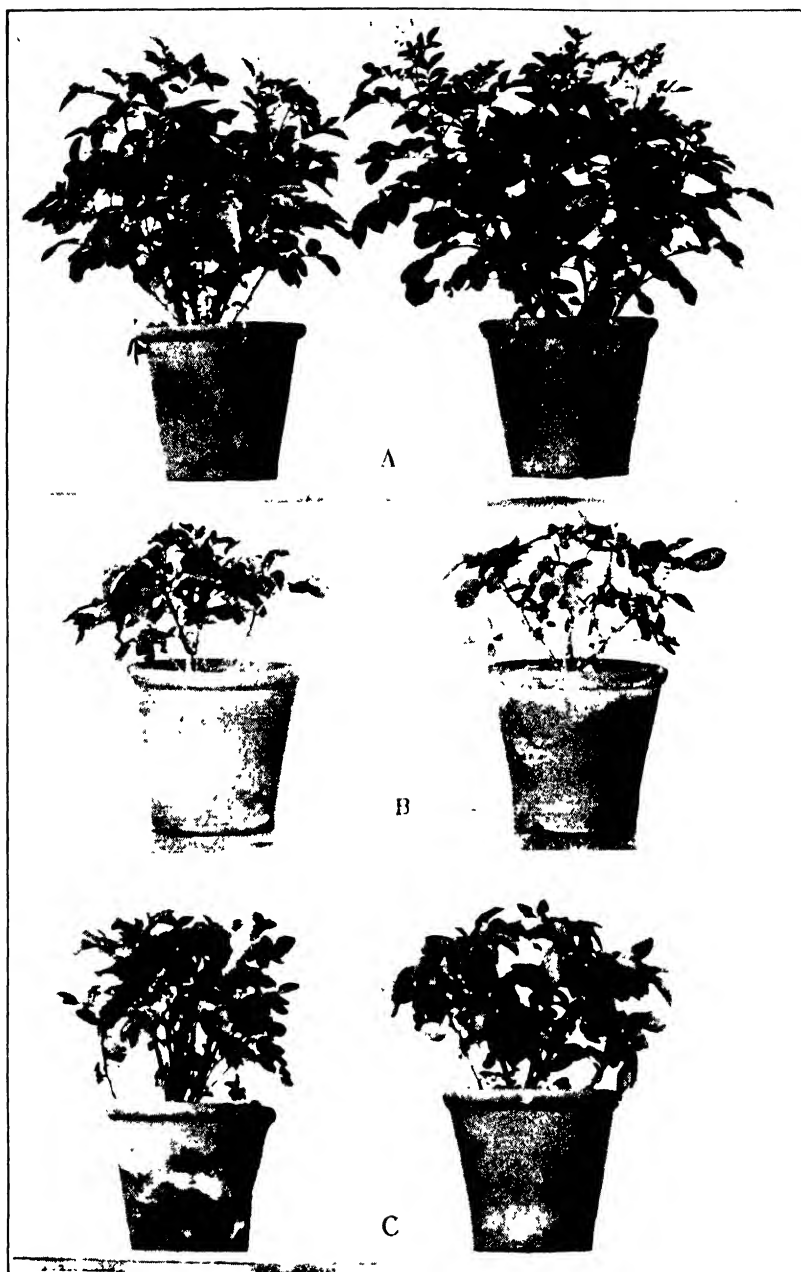


FIG. 1. - *A*, Sterilized soil. *B*, Non-sterilized soil.
C, Sterilized soil inoculated with *Heterodera schachtii*
and *Corticium* (*Rhizoctonia*) *Solani*.

THE CONTROL OF A SERIOUS POTATO TROUBLE.

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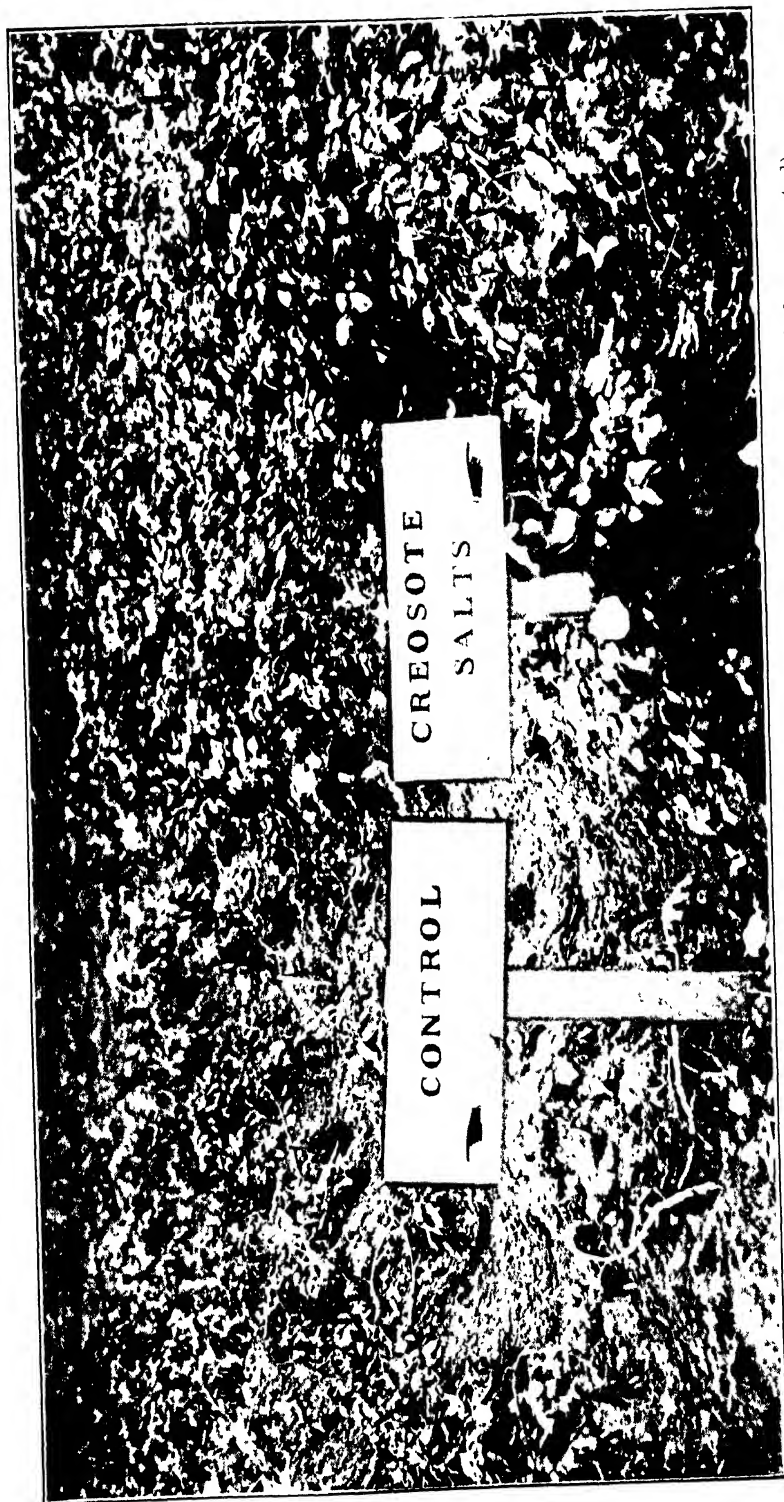


FIG. 2.—Appearance of crop on plot treated with Creosote Salts compare 1 with that on control plot (untreated).

amount of fungus as well as of eelworm was considerably more in the latter series ; but some other factor, or factors, may have been involved.

The photograph reproduced in Fig. 1 was taken during the last week in June, and gives some idea of the difference in growth. The pots marked A were from Series I, in which sterilized soil had been used ; those marked B from Series IV, in which sterilized soil inoculated with both the eelworm and the fungus had been used ; and those marked C from Series V, in which non-sterilized soil had been used.

The experiment is too small to justify definite conclusions, but taken by itself it suggests that the cause of the trouble may lie in the presence of the eelworm *Heterodera schachtii* and the fungus *Corticium Solani*, and not, as had seemed possible from field observations, in unsatisfactory conditions of soil fertility. However, the whole question is under study and further work is being done for the purpose of elucidating these points, as well as many other problems connected with the complaint.

Remedial Measures.—In 1927 the writer decided to carry out pot experiments on the control of the trouble. Many chemicals were tested with the hope of discovering a cheap and effective means of disinfecting or cleaning the soil of disease-producing organisms. Of the chemicals tested the following gave very promising results, namely—"Drained creosote salts,"* carbon disulphide, calcium cyanide and calcium cyanamide.

In the following year (1928) these chemicals, as well as quicklime, were tested under field conditions. The field selected for the trials was known to be thoroughly potato-sick, and the last potato crop grown in it had been almost a complete failure.

The experimental area was uniform as regards previous cropping, cultivation and manuring. The previous cropping was : 1920, potatoes ; 1921, oats ; 1922, wheat ; 1923, clover and seeds mixture ; 1924, clover and seeds mixture (second year) ; 1925, potatoes (Eclipse) ; 1926, spring cabbage followed by cauliflower ; 1927, peas followed by spring cabbages. The soil might be described as a sandy loam, typical of soil

* "Drained creosote salts" is the name applied to a crude form of naphthalene, which contains small quantities of other coal tar derivatives.

found in the north-east of the Holland Division of Lincolnshire, and very suitable for growing early potatoes.

The mechanical analysis was as follows (per cent.) :—

Moisture	3.90	Fine sand	45.38
Loss on ignition ..	6.27	Silt	17.50
Carbonates (CO ₂) ..	0.48	Fine silt	7.50
Coarse sand	0.52	Clay	15.75
Loss by solution ..		2.85	

The following is a chemical analysis of the soil from this field, which is better than that of the average for the soils in the district (per cent.) :—

Nitrogen	0.359	Available potash ..	0.063
Available phosphates	0.190	Calcium carbonate ..	1.10
Lime requirement ..		Nil.	

This analysis shows that there was no deficiency in essential "plant-food," which might account for the failure of the potatoes.

Plan of the Experiment.—The variety used was "Eclipse" (Scotch seed once-grown in Lincolnshire). It will be seen from the plan of the experiment below that the experimental area was divided into 12 plots, and each plot had an area of 1/20th of an acre.

TABLE I.—PLAN OF EXPERIMENT

15.5 yd.

8.5 yd.	Carbon disulphide 3a	Creosote salts 2a	Calcium cyanide 4b	Quicklime 6b
	Calcium cyanamide 5a	Control 1a	Carbon disulphide 3b	Creosote salts 2b
	Calcium cyanide 4a	Quicklime 6a	Calcium cyanamide 5b	Control 1b

The distance between the rows was 2 ft. 2 in. and between the plants 1 ft. 2 in. The seed, which was well sprouted, was planted on April 27, at the rate of about 16 cwt. to the acre. No dung was used, but a dressing of artificial manure at the rate of 15 cwt. per acre was added at the time of

planting to all the plots, and was made up in the following proportions :—

3 parts sulphate of ammonia	(8.3 per cent. Amm.)	
4 „ superphosphate	(13.3 „ Sol. Phos.)	
2 „ sulphate of potash	(11.1 „ Pot.)	

This mixture is considered suitable for second early potatoes in South Lincolnshire soil.

Chemicals Employed.—The following five chemicals were applied to the respective plots at the rates given below :—

“ Drained creosote salts ” at the rate of 8½ cwt. per acre				
Calcium cyanamide	„	10	„	„
Quicklime	„	30	„	„
Calcium cyanide	„	5½	„	„ (or 2 oz. per sq. yd.)
Carbon disulphide	„	30	gals.	„ (or 1 oz. per sq. yd.)

Method of Application of Chemicals.—All the substances were applied 12 days before planting the potatoes. The “drained creosote salts,” calcium cyanamide and calcium cyanide were broadcast, and ploughed in immediately after the application to a depth of about 6 in. The liquid carbon disulphide was applied by means of a pneumatic hand sprayer having a capacity of 3 pints. This machine distributed the fluid in a fine, misty spray over the bottom of the furrow at a uniform rate in front of the plough and the chemical was thus immediately covered in. The quicklime was evenly spread and harrowed well into the soil. All the plots were then given a double harrowing with a light harrow, followed by rolling with a heavy roller, in order to impregnate the soil thoroughly with the chemicals and avoid as far as possible the escape of their gases.

Observations on the Plots.—The plants made rapid growth, and very little difference could be detected between the various plots until the middle of June, except in the calcium cyanamide plots. In this case growth was decidedly slower, as if some retarding agent was at work. At the end of June a decided contrast could be drawn, and it became evident that, whatever their effect might be on the soil or the organisms in it, the majority of the chemicals certainly exerted a marked influence on the growth of the crop. The plants in the “drained creosote salts” plot were vigorous and of a healthy colour; the untreated or control plots contained many unhealthy plants with withered leaves, and the majority of them were stunted in growth; the carbon disulphide plots

were nearly as good as the "drained creosote salts" ones, the calcium cyanamide and calcium cyanide plots were equal and not far behind the carbon disulphide ones; the quicklime plots showed but little improvement over the controls. As the season progressed the differences became more and more marked, and by the end of July were most striking.

At this time the haulms on the control plots had completely died down; those on the "drained creosote salts" plots were green and luxuriantly healthy; those on the quicklime plots did not seem much better than the ones on the controls; those on the carbon disulphide, calcium cyanide and calcium cyanamide plots had not completely died off, but it was obvious that very little further tuber growth could be expected, except perhaps on the carbon disulphide ones. The difference between the plots treated with "drained creosote salts" and the rest, particularly the controls, was so marked that it could be detected a quarter of a mile away. The photograph in Fig. 2 was taken during the last week in July, and shows, on the right, the appearance of Plot 2b, treated with "drained creosote salts," and, on the left, the control, Plot 1b.

The Crop.—Before lifting, it was evident that a much heavier crop would be obtained from the "drained creosote salts" and the carbon disulphide treated plots than from the others. All the plots were lifted on August 15, and in order to get an accurate determination of yields under the various treatments, each plot was lifted carefully by hand. When the potatoes were being lifted the total crop from each of these plots was weighed separately. The weights are in Table II opposite.

Considering first the control or untreated plots, it will be seen that they gave the least yield. This is explained by the fact that the haulms in these plots ripened off or died prematurely. The results of the application of each of the chemicals, as shown by the increased yield, can be ascertained if the yield of the treated plots be compared with that of the untreated or control plots. The highest increase is found in the plots treated with "drained creosote salts." The average crop of tubers of these two plots (Plots 2a, 2b) on an acreage basis was 11.02 tons as compared with 6.57 tons for that of the controls (Plots 1a, 1b). The increase in yield due to soil treatment with "drained creosote salts" was,

TABLE II.

Soil	No. of plot	Total yield	Per acre	
			Average yield	Increased yield over control
Control (untreated) ..	1a	cwt. lb. 3 18	tons cwt.	tons cwt.
	1b	3 47		
		6 65	6 11.5	
" Drained creosote salts "	2a	5 53		
	2b	5 63		
		11 4	11 0.5	4 9
Carbon disulphide ..	3a	4 89		
	3b	4 93		
		9 70	9 12.5	3 1
Calcium cyanide ..	4a	4 30		
	4b	4 84		
		9 2	9 2.5	2 11
Calcium cyanamide ..	5a	4 32		
	5b	4 33		
		8 65	8 11.5	2 0
Quicklime	6a	3 101		
	6b	3 77		
		7 66	7 11.5	1 0

therefore, at the rate of approximately $4\frac{1}{2}$ tons to the acre. Increased yields were also obtained with the plots (Nos. 3, 4, 5, 6) treated with carbon disulphide, calcium cyanide, calcium cyanamide and quicklime, there being apparent gains of 3.05 tons, 2.55 tons, 2 tons, and 1 ton respectively over the controls. It is doubtful how far these increases can be regarded as significant except those with the "drained creosote salts" and with the carbon disulphide; these substances have apparently benefited the crop very considerably.

No conclusions can safely be drawn as to the nature of the effects produced by the chemicals employed, but it may be pointed out that such effects may be due to (a) the destruction of some disease-producing organism (or organisms) and (b) the partial soil-sterilization effect which would be caused

by heavy dressings of such a chemical as "drained creosote salts."

Cost of Treatment and Value of Return.—From the purely practical point of view the following table shows the cost of the different dressings and the apparent returns per acre :—

TABLE III.

Dressing	Per Acre				
	Cost of dressing	Calculated yield of crop	Increased yield of crop	Value of the increased yield at £5 per ton	Net profit
	£ s. d.	Tons	Tons	£ s. d.	£ s. d.
Control (untreated) ..	Nil	6.57	Nil	Nil	Nil
"Creosote salts" ..	4 0 0	11.02	4.45	22 5 0	18 5 0
Carbon disulphide ..	15 5 0	9.625	3.05	15 5 0	Nil
Calcium cyanide ..	36 0 0	9.125	2.55	12 15 0	23 5 0 (net loss)
Calcium cyanamide ..	4 10 0	8.6	2.0	10 0 0	5 10 0
Quicklime ..	4 0 0	7.6	1.0	5 0 0	1 0 0

Suggestions.—In view of the results obtained in the experiments described above, it appears that "drained creosote salts" are worthy of further trial. It is suggested that this chemical should be broadcast twelve days before the potatoes are planted at the rate of about 8 cwt. to the acre, and then immediately ploughed in to a depth of 6 in.

The author has pleasure in recording the valuable help given by Mr. W. F. Cheal, D.I.C., N.D.A., who assisted with the pot experiments; grateful acknowledgment is made of the assistance received from Mr. M. N. Nicholson, B.Sc., A.I.C., in carrying out the mechanical and chemical analyses of land in which the experiments on remedial measures were conducted; and special thanks are due to Principal J. C. Wallace and to Mr. J. C. F. Fryer, M.A., of the Ministry's Plant Pathological Laboratory for their encouraging interest in the work.

SHEEP SCAB

THE continued unsatisfactory position of Great Britain with regard to Sheep Scab revealed by the returns from Local Authorities during the year 1928 has recently been under consideration by the Minister. In this year there were 744 outbreaks of the disease as compared with 723 in 1927, and with an average of 667 for the preceding five years.

It will be recalled that the central control of Sheep Scab was undertaken by the Ministry in 1905, following the passing of the Diseases of Animals Act, 1903, which empowered the Ministry to make Orders for prescribing the periodical treatment of sheep by dipping or other means as a remedy for sheep scab.

The average number of outbreaks of sheep scab per annum during the years 1870 to 1904 inclusive was 2,086 and the number never fell below 1,200 in any of those years. Although there has been a marked improvement since 1905 as compared with the preceding years, the average number of outbreaks per annum from 1905 to 1928 being 565, unfortunately no progress towards eradication has been made since the War.

Of the 744 outbreaks in 1928, 307 occurred in England, 358 in Wales, and 79 in Scotland. The figure for England (307) is the lowest since 1922, and the position in Scotland is the most favourable, with one exception in 1924 (58 outbreaks), since the year 1915. In Wales, however, the disease has become increasingly prevalent and the number of outbreaks (358) in 1928 is the highest since 1909. Of this number, 285 occurred in the six counties of North Wales. It will thus be seen that one-third of the total number of outbreaks in Great Britain occurred in the six counties of North Wales, which are mountainous and where unfenced sheep runs common to many sheep owners exist.

Success in eradication depends mainly upon three factors :—

- (1) Prompt reporting of suspected cases by the owner.
- (2) Application by the Local Authorities of the procedure laid down by the Sheep Scab Order of 1928.
- (3) Efficient dipping by the owners both of the affected flocks and of all sheep in infected areas.

The Ministry has given much attention to the question of the eradication of sheep scab, and has thoroughly explored the causes of the lack of progress. The anti-sheep scab regulations have been under review from time to time and were carefully revised in the Sheep Scab Order of 1928 issued on January 25 of that year. These regulations are based on scientific knowledge

of the life history of the sheep scab parasite, and also upon the experience of the control and eradication of the disease in this and other countries. The Ministry is satisfied that these regulations are capable of eradicating sheep scab within a reasonable time, provided that they are consistently applied by the Local Authorities whose duty it is to administer them, and also that they are thoroughly and conscientiously carried out by sheep owners.

The outstanding fact revealed by the Ministry's investigations is the neglect on the part of sheep owners to report the existence of sheep scab in their flocks as required by the law. During the year 1928 alone 168 outbreaks, or 22 per cent. of the total number of confirmed outbreaks in Great Britain, were not reported to the Police but were detected solely by visits of the Ministry's and Local Authorities' Inspectors. These were distributed as follows: 52 cases in England, 85 in Wales, and 31 in Scotland. It is reasonable to infer from this general failure to report, that many more cases were neither reported by sheep owners nor discovered by Inspectors, and remained centres from which the disease subsequently spread and gave rise to further outbreaks.

Another disquieting feature of the present position which has been disclosed, is the failure on the part of many owners of sheep to comply with the preventive regulations as to dipping.

The majority of County Authorities in Great Britain exercise their power to make regulations for the dipping of sheep within their counties and of sheep imported into their counties from elsewhere. Evasion of these Regulations, however, is not uncommon. An Inspector of the Ministry recently found that a large number of persons had imported sheep into a Midland county without either reporting their arrival or double dipping them as required by the County Regulations. Further inquiries showed that 14 other persons in 8 counties of the Midland Group had similarly failed to comply with the Regulations.

The anti-scab measures now in operation were inaugurated in response to representations made to the Government by agriculturists themselves, but unless the agricultural community are in earnest in desiring the benefits which the Act was intended to confer, and in supporting Governmental action thereunder, neither these nor any other measures can achieve eradication of the disease. The facts which have been described above would seem to show that in many parts of the country sheep owners are not in earnest in this matter, or there would be no such general failure to report the disease when it exists, or

to carry out effectively the remedial measures prescribed. It is true that persons found guilty of evasion of the Orders of the Ministry or of the Regulations of Local Authorities are usually prosecuted and convicted. Some of the penalties imposed have been substantial whilst others have appeared small, having regard to the general grounds of policy involved. Convictions and fines, however adequate, will not improve the efficient working of the anti-scab regulations in the absence of a change in attitude, on the part of the agriculturists concerned, towards the question of eradication.

In all these circumstances it is feared that little improvement is to be looked for in the future position of the country with regard to sheep scab, until there is a change of attitude on the part of many sheep owners, doubtless the minority, towards the regulations.

On March 6 last, the Minister received a deputation from the Royal Agricultural Society of England and the National Sheep Breeders' Association, when the question of the policy adopted for the control and eradication of sheep scab was discussed. Subsequently the Ministry issued an urgent appeal to all Local Authorities, Police Authorities and agricultural bodies, particularly sheep societies, to make an earnest effort to secure the effective application of the regulations, and to endeavour to stir up a feeling of enthusiasm amongst farmers in the attempt to get rid of this eradicable disease.

That success in the eradication of sheep scab can be achieved by an energetic compliance with the regulations, is shown by the fact that in certain counties, which a few years ago were the scene of serious epidemics, the disease is now non-existent.

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THE LANCASHIRE PIG TRADE

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MUCH of the literature relating to the pig trade is dominated by the needs of the bacon curing establishment on the one hand and the dead meat market on the other. That there are other elements in the trade not to be neglected, at least as far as Lancashire is concerned, appears from a survey which was carried out by the writer during the past year whilst on the staff of the Agricultural Education Committee of the Lancashire County Council.

As is to be expected, Lancashire is an importing county, not only in regard to pig products, but to live pigs also. It is conveniently situated for receiving supplies from Ireland, while into the towns in the southern part come further quantities from the cheese-making areas of Cheshire, from North Wales and even as far away as Lincolnshire. Exports from the county comprise sows sent to large sausage-making firms and baconers sent to large curing establishments. Occasional consignments of porkers are made to markets as distant as London, in order to take advantage of a temporary price differential. As regards supplies of live pigs within the county, the number on farms has increased from about 40,000 in 1870 to roughly 80,000 at the present day. The human population has increased by 75 per cent. in the meantime. The figures for pigs relate to farms of one acre and upwards, and during the period named there has been a considerable reduction in the numbers kept by cottagers and urban dwellers. It thus appears that there has been no great increase in the pig population *per capita* during the period.

In the Lancashire pig trade three main factors are to be distinguished :—

- (1) The trade in fresh pork as carried on mainly by beef butchers. The pigs are cut up as far as possible into fresh pork joints sold with the rind on, and into chops, etc., leaving the minimum to be made up into subsidiary products. This trade is distinctly a seasonal one, commencing in September and continuing until April. A small volume of trade is carried on through the summer, its amount fluctuating with the vagaries of the weather. During a spell of hot weather it falls off, while in cold weather it is stimulated. The general impression seems to be that the summer trade shows a tendency to increase to a greater extent than can be explained by the character of the seasons.
- (2) The typical pork butcher's trade, in which the carcass is disposed of partly as fresh pork, partly as home-cured bacon and partly in the form of sausages, pork pies and various other subsidiary

products. According to the most common practice the carcass is cut down the middle of the backbone, the head is removed; the ham is cured separately or sold fresh for roasting; the sides are severed dorso-ventrally behind the shoulder, the ventral part of the shoulder being used for sausages, etc., and the chine part in a similar way or else cured by itself. The ribs are sawn through and from each side the lean flesh of the back is removed as a length of pork with very little fat and without the rind. The rest of the side, including the fat of the back, is cured on the pork butcher's premises. A sufficient thickness of back fat is required to leave a fair thickness under the rind for curing, after the pork length has been taken out. The actual practice of cutting, though on these general lines, varies in detail according to circumstances, as explained in a subsequent section.

- (3) The Wiltshire-side bacon trade. In this, the carcass is divided down the middle of the spine; the head, feet, tail, backbone, shoulder-blade, aitch-bone, kidneys and kidney fat, tenderloin and leaf fat are removed; the sides are then ready for curing. For the Wiltshire-side trade a long pig with a good proportion of lean to fat is required. This class of trade is of minor importance in Lancashire, though some few pigs are collected by dealers for despatch to large curing firms in other areas.

It will be evident that no one type of *carcass* will meet all requirements. The size and degree of finish or fatness required varies with the district and with the particular branch of the trade for which it is destined. The differences are rather in respect of the stage to which feeding is carried than in the type of animal kept. For all purposes, a pig is required to be light in the head and shoulders, and to have fine bone well fleshed down, particularly towards the hocks. Even in the "trotters" alone there may be a difference of 4 lb. between a medium-sized, properly finished pig and a large leggy pig of about the same weight; on such a low-priced part of the carcass, the added weight appreciably affects the financial results from the pork butcher's point of view. Such pigs will only be purchased at a lower price.

The flesh should be firm and thick, with plenty of lean. In particular, a thick, round ham is required. While the family butcher desires a pig with a thick ham and a well-fleshed loin, the pork butcher is also particularly concerned with thickness of belly and flank. For the pork butcher's trade it is essential that the thickness of flesh shall extend not only over the loin but down to the belly as well. Otherwise a good flitch of bacon cannot be obtained. Certain types of pig are said to be notorious offenders in this respect, in that a well-fleshed appearance on the back proves a deceptive guide, the belly being thin and light.

On the whole, it seems probable that one type of *pig* could be made to serve most purposes quite well, by variation in the

method of management. The fundamental necessity is a pig which is sufficiently early-maturing to be marketed at the lighter weights if desired, and yet which does not become excessively fat if fed to a later stage. Other factors have naturally to be considered by the farmer, but here the single point of suitability to trade requirements is in mind.

In regard to the weight and degree of finish or fatness, these vary with the class of trade, the locality, the season, and the prevailing prices of bacon.

For the trade carried on by beef butchers, the small porker or cutter is mainly required, varying in weight from 3 to 6 scores dead weight. The flesh should be thick but lean in character and the back fat should not much exceed an inch in thickness. In Manchester and Liverpool, a carcass of 3 to 5 scores is most in demand, the latter having an apparent preference for carcasses less than 4 scores in weight. At the other extreme, in Wigan and the mining districts in the vicinity, a carcass of 8 to 9 scores is most popular. There is, in these latter districts, only a small demand for porkers of less than 5 scores dead weight, with the noteworthy exception of Christmas week. In other Lancashire towns, pigs which yield carcasses of 4 to 7 scores meet the butcher's requirements.

This class of trade is a seasonal one, shrinking to small proportions during the period from May to August. Pork is popularly said to be in season when there is an "R" in the month. The volume of trade increases very largely in the week or two before Christmas, and the increase is continued in a less degree during the first week of the New Year. Consumer-demand is moving slowly but definitely in the direction of leaner and smaller joints, consequently it is especially among those who cater primarily for the fresh pork trade, that the most inflexible insistence on small carcasses is found.

For the pork butcher's trade on the other hand, a larger pig of 7 to 10 scores, according to the locality, is required. In the mining areas of East Lancashire, there is a preference even for pigs of 10 to 14 scores dead weight. A well-finished pig with $2\frac{1}{2}$ to 3 inches of back fat is in most common demand, while, in the mining areas just referred to, the fatter the pig the better. There must be sufficient back fat to yield a fairly thick flitch of bacon after the pork is removed. The demand, however, varies somewhat according to the season of the year, a variation of which an explanation will appear from the following.

During the pork season, the pork butcher is able to sell a large part of the pig meat as fresh pork, and he regards this as the most remunerative part of his trade. In fact, the sale of home-cured bacon and manufactured products is often regarded as merely subsidiary to that of fresh pork. During the pork season, the whole of the back may be sold as fresh pork, loin and chops—with or without rind. In this case, only a belly is left for curing, besides hams and shoulders, and part of the belly may be sold as "pork bacon" which is consumed in the same way as ordinary bacon but does not undergo the preliminary curing process. If the carcass is to be divided in this way, it is essential that there should not be any great thickness of back fat, as this will have to be trimmed off from the pork and rendered down for lard at a loss. Further, if the rind can be left on, this represents a further portion which assumes the value of fresh pork instead of that of offal. Hence, for the winter trade, a fairly lean pig is wanted.

In the summer, however, the sale of fresh pork declines to comparatively very small proportions. A lighter pork length is then taken out from the back, with very little fat. The remainder of the fat, with the rind, is left on the side and the whole cured as a flitch of bacon. In this case, such a thickness of fat is required as will leave a flitch of fair thickness. Obviously a side of bacon which diminished to say no more than an inch in thickness on the back portion would present an unattractive appearance and would bear a disproportionate amount of rind. Hence arises the somewhat anomalous situation that for the pork butcher's trade a fat pig is required in summer and a leaner one in winter. This is in sharp contrast to conditions in the beef butcher's trade, in which fat pigs are rigorously eschewed in summer.

In some cases the side, after removal of the shoulders and hams, may be cured without the removal of any flesh for pork. Hams may either be cured or may be sold for roasting.

Requirements are influenced to a considerable extent by fluctuations in the bacon trade. When prices are ruling low in the bacon market, pork butchers are very much afraid of accumulating large stocks of home-cured bacon. Such bacon has a small proportion of lean and cannot compete in the best class of trade with the Wiltshire-side bacon produced by the large curers, and with that imported from Denmark. In its own sphere, too, its price is influenced by the large quantities of rolled bacon imported from Ireland. So important is this factor of bacon prices that the almost unanimous opinion of

those engaged in the Lancashire pig trade is that the pig market is ruled by the price of foreign bacon rather than by that of fresh pork at home. When the bacon trade is slack, butchers endeavour to purchase pigs which will leave as little as possible for conversion into bacon. Smaller pigs carrying little outside fat then come into demand. Further, a brisk trade in fresh pork leaves the pork butcher with rapidly accumulating stocks of home-cured bacon and, from Christmas onwards, he is often compelled to buy smaller pigs in order to check the accumulation.

There is an apparent tendency for it to become increasingly difficult to sell this home-cured bacon which has had most of the lean removed. Consumer-demand is moving in the direction of smaller rashers of bacon, well streaked with lean and mild-cured. It is noticeable that where on many farms it was customary to kill a fat pig or two each winter, cut off most of the lean for fresh pork and pies, and salt the remainder for consumption during the rest of the year, bacon is now seldom cured at home, ready sliced mild-cured bacon being bought from the retail stores. Farm labourers are not now so often observed making their mid-day meal of a piece of bread and a thick slice of cold, boiled fat bacon. In the town the same tendency is at work, and it is stated that, in the poorer districts especially, the leaner article is preferred. It seems probable that these influences will tend to create an increasing preference for smaller and leaner pigs.

The warm atmosphere in the factories is suggested as a reason for low consumption of pork and a dislike of fat pork among industrial workers. It is said that the factory workers, who will on no account purchase pork in the inland industrial towns, will consume it with avidity when living at holiday times in the cool and bracing air of the coast towns. The statement seems feasible when correlated with the observation that the coast resorts evince a demand for small porkers in the summer months. There is, however, a concurrent demand for lamb and veal at holiday resorts, and it is probable that holiday luxury is a contributing factor.

In the mining districts of Lancashire the demand for fat pork persists. Miners find that fat pork keeps moist in the pits, and it is used largely in the form of sandwiches for consumption while down the pits.

Variations between the requirements of different districts are not entirely logical, but are created largely by vagaries of local usage. In some places, there is a ready sale for fresh

pork with the rind left on ; in others. the demand for such is very limited, and the rind and much of the back fat must be removed before sale. This consumer-preference is one of the main factors in determining the method of division of the carcass. The demand for manufactured meats, as sausages, pork pies and various articles of a similar nature, also plays its part and, in this connexion, the ingenuity of the pork butcher in displaying edible offals in an attractive form has a bearing on the economics of the business. It is complained that the pork butchers in certain towns are not so far advanced in this respect as those in other towns, and that Lancashire as a whole does not compare favourably with, for example, the Midlands. It is a matter of stimulating demand by attractive presentation rather than of allowing demand to stimulate greater proficiency in the art of making up. Demand for ready-cooked meats appears to be on the increase. As a matter of fact, it appears that some loss is entailed on almost all the subsidiary products as compared with sale as fresh pork. Yet large numbers of pork butchers in business buy big pigs yielding a higher proportion of materials which need to be made up into subsidiary products, when they might, instead, buy small porkers which can be sold mainly in the fresh state. The apparent explanation is that such retailers are in business by virtue of their trade in made-up products, and that the sale of part of the carcasses as fresh pork forms a way of increasing the returns incidental to such trade, whilst an accumulation of home-cured bacon is one of its consequences.

Co-ordination of Demand and Supply.—It is not easy to form an accurate idea of the relative importance of the demand for porkers and cutters on the one hand, and of the larger pigs suited to the pork butcher's requirements on the other. Such indications as there are, however, point to the overwhelming preponderance of demand for the latter type. Even in Manchester, where porkers and cutters are in considerable demand, and pigs of this type are received from various parts of Lancashire, it is stated that the number of the larger dual-purpose pigs handled much exceeds that of the smaller pigs. In Bolton, the relative proportions appear to be something like 10 to 1 in favour of the dual-purpose type. In Wigan and Preston, the demand for small porkers is small and confined mainly to the Christmas trade.

At Barrow, on the other hand, small porkers of about 5 scores deadweight find the readiest market. Small pork is also required during the summer for the seaside resorts of

Blackpool, Southport and Morecambe and, in the first-named town, it is stated that about ten times as many porkers as large pigs are required. The seaside trade, however, is not of sufficient volume to affect the general situation in the county. In most places there is a sharp inquiry for small porkers (4 to 5 scores) at Christmas time.

The general view of pig dealers is that there is a demand somewhere for practically all classes of pigs and that it is their business to co-ordinate demand and supply. This appears to be true, but it by no means follows that it is a matter of indifference to the farmer what kind of pig he produces. The dealer's functions are not accomplished without cost. Some pigs produced in the north of the county are railed to Manchester, Birmingham and even London, while pigs from Cheshire find their way up to Wigan, Bolton, and St. Helens.

One element in the demand for heavy pigs in some districts is said to be the fact that local consumers can be induced to take the produce of very fat pigs, while such pigs can be obtained by butchers at less cost than lighter pigs. Factors which increase the dealer's costs increase the margin which he must allow in order to keep in business. Obviously, however, the lower these costs, the more will remain for the farmer after the dealer's legitimate profit has been allowed for. Nor is there much fear that the saving would be entirely appropriated by the dealers. Competition is active enough to prevent such a contingency.

There is a tendency to assume that, over the country as a whole, pigs are being fed to greater weights than are required, and this seems obvious from the premium which the smaller pigs generally command. As far as Lancashire alone is concerned, the contrary is often the case. In Preston, for instance, there is often a surplus of small pigs and a shortage of the 9 to 10-score pigs required by the pork butchers. The still heavier pigs required for the mining districts are obtained mainly from the Cheshire cheese-making districts. It must be remembered that pigs which are too heavy and fat for the Wiltshire-side trade may be actually too lean for the needs of the pork butchers in some areas.

TAR—DISTILLATE WASHES AND RED SPIDER

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WHEN tar distillate washes for fruit trees were introduced into this country some seven or eight years ago, it was thought that the problem of pest control would be considerably simplified by their use. Spraying could be done during the winter without seriously interfering with other routine operations; the trees could be sprayed more easily and efficiently during the dormant season and with less risk of damage; and, since pests could be destroyed in the egg stage, much summer spraying with nicotine or lead arsenate could be eliminated. These and many other advantages were claimed for tar washes by their introducers, and to some extent their claims were borne out. As time went on, however, the real uses and limitations of these washes became better known and understood, and it is now realized that the tar-distillate washes in common use are very toxic to the eggs of Aphids,¹ Apple Sucker and Scale; only moderately toxic to the eggs of Winter Moth; of doubtful value against the eggs of Capsid Bugs; and quite or wholly ineffective against the eggs of the Fruit Tree Red Spider (*Oligonychus ulmi*). American Blight (Woolly Aphis) is also scarcely affected. The general cleansing and invigorating properties of tar washes are undisputed.

Recently a new point has come to light: it has often been found that where these washes were used on fruit trees for several years in succession, Red Spider (the Red Spider Mite) became more abundant and frequently became an important pest. Of the various explanations advanced to account for this, the most likely appeared to be that the continued use of tar washes destroys or discourages some parasitic or predaceous insect which normally keeps down the numbers of Red Spider. Observations made at East Malling Research Station during recent years give some support to this hypothesis. The writers have observed that several insects, notably a small predaceous bug, *Anthocoris nemorum*, commonly feed on red spiders and their eggs, and it seems probable that the habits of some of these insects are interfered with by winter washing.

¹ These include the Permanont, Green, and Rosy Aphids of apples, Mealy Aphis of plums, and various aphids which attack gooseberries, currants, roses, etc.

Anthocoris nemorum.—This insect (Fig. I) belongs to a family of true bugs, of which all the members are very predaceous and live by preying on other insects. They have certain affinities with the Capsid Bugs but are more closely allied to the Bed Bug. When mature, this bug measures rather less than $\frac{1}{4}$ inch in length. The head and the part of the body immediately behind the head (the *thorax*) are pitchy black; the forewings (which, when not in use) completely cover the rest of the body, are whitish at the base, blackish about the middle, and whitish with dusky patches at the apex (*i.e.*, the membranous portion at the tail end). The feelers consist of four small joints, dark in colour. The eyes are very prominent and, like the rest of the head, pitchy black. The legs are mostly brown, but the basal joints (thighs) are darker. The whole insect is smooth and shining, and rather flattened.

After hatching from the egg, this bug has to pass through five immature stages before developing into the adult described above. The immature stages are red to reddish brown, smaller than the adults, broader and flatter by comparison, and are unable to fly. The earliest stages are as small as one millimetre in length. After the second moult the rudiments of the wings appear and can be seen with the aid of a microscope, but are scarcely visible through even a strong pocket lens. After the third moult, these wing pads are larger and can be seen with a lens. After the fourth moult, they are quite large and visible to the eye, and, at the fifth moult, the fully winged adult appears.

The insect is armed both in the immature and adult stages with a short beak, adapted for piercing and sucking. This consists of a hollow tube containing two pairs of needle-like stylets, and may be carried tucked out of sight beneath the head, or, as is frequent when hunting for prey, held out in front of the head. With this weapon the bug readily attacks all manner of small insects such as aphids, leafhoppers and *Red Spider*.

The nymphs (immature stages) appear to feed on red spiders to a greater extent than do the adults, which, being stronger and more active, are better able to tackle larger prey. It is interesting to watch one of these nymphs searching a leaf for red spiders and their eggs; it will walk the length of a leaf, carefully and systematically probing with its beak on either side of a vein, where the mites and their eggs are most numerous, sucking dry all those it finds. Indeed, *Anthocoris nemorum* often lays its eggs on leaves which have an abundance of red

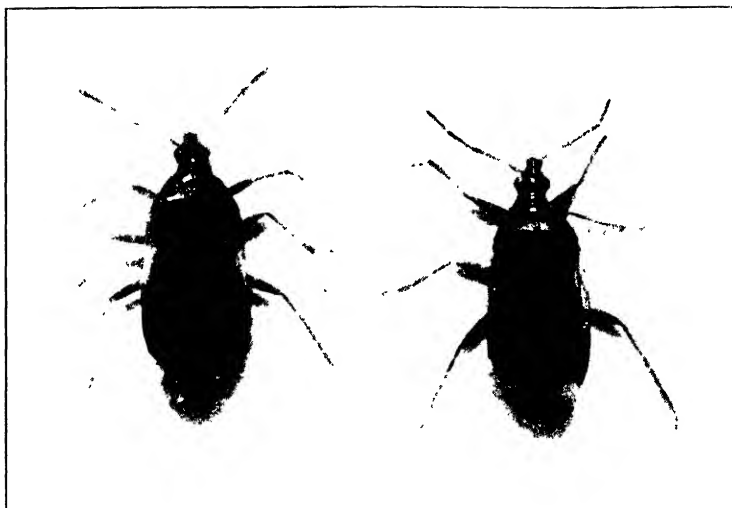


FIG. 1. Adults of *Anthrenus nemorum* L. (greatly enlarged)

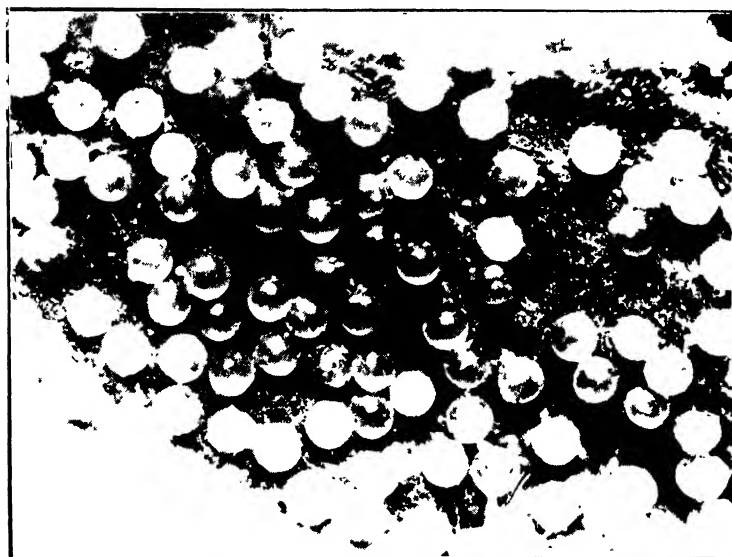


FIG. 2. Winter Eggs of Fruit Tree Red Spider, *Oligonychus ulmi* Koch, on apple bark. (greatly enlarged)

TAR DISTILLATE WASHES AND RED SPIDER.

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spiders. Some plum leaves, badly infested with the Fruit Tree Red Spider (*Oligonychus ulmi*), were examined in August, 1928, and several Anthocorid eggs were found, laid singly and partly embedded in the under surface of the leaf. These soon hatched and yielded the small red nymphs of *Anthocoris nemorum*, which soon began to wander over the under side of the leaves in search of red spiders and eggs.

This bug is usually common on all kinds of fruit trees and bushes and on hops. There are apparently several successive generations during the year, since all the immature stages and adults may be found contemporaneously throughout the summer. The winter seems to be spent in the adult stage only, the bug sheltering under moss and loose bark, in crevices, and in coarse grass and rubbish on the ground.

In old neglected orchards where winter spraying is not practised, this and other predaceous bugs usually occur in far greater numbers than in well-kept regularly sprayed plantations, and it is a well-known fact that Red Spider is usually less prevalent in neglected orchards. It seems reasonable to suppose that, since *Anthocoris nemorum* hibernates as an adult (and not as an egg protected by the bark under which it is laid, as do the Apple Capsid and Common Green Capsid Bugs), winter washing has a deleterious effect on it. This might occur in any of the following ways :—

- (1) by removing loose bark, etc., from the trees and so reducing the available amount of winter shelter ;
- (2) by actually killing numbers of the bugs whilst they are hibernating under bark, in cracks and crevices of the trunks, branches and support stakes ; and
- (3) by killing those which find shelter amongst dead leaves, grass and other ground rubbish around the trees.

Other Insects Preying on Red Spider.—The above remarks would apply also to other predaceous bugs of similar habits.

In addition to the Anthocorid Bugs, certain of the Capsid Bugs can be predaceous on occasions. One in particular, *Malacocoris chlorizans*, frequently feeds on red spiders and their eggs. Probably many other bugs do likewise, but, so far, the *Anthocoris* is the only insect we have found to do so habitually. At present little is known of the habits of the other predatory species.

An insect of another type which has been observed to feed on Red Spiders is the Two-Spot Ladybird Beetle, which instead of sucking, chews its prey. It is by no means clear, however, whether this may not be only an occasional habit

of the Ladybird. Here again the winter is spent in the adult stage.

It is not known whether the winter eggs of Red Spider are attacked by hibernating individuals of *Anthocoris* and other predaceous insects. The eggs alluded to above were summer eggs.

The Control of Red Spider.—Although it might seem a serious objection to tar-distillate washes that Red Spider may possibly be increased by their use, growers should not be deterred from using them, since their effect on aphids, sucker, etc., is undoubted, and it may yet prove possible to find an improved winter wash capable of killing the eggs of Capsid Bugs and even of Red Spider.

When a serious infestation of Red Spider occurs, it is best combated by the use of sulphur preparations. The following are good formulæ :—

Lime-Sulphur

Lime-sulphur (Sp.gr. 1.3)	1 gal.
Water ..	..	..	..	29 „

Liver of Sulphur

Liver of sulphur	50 oz.
Soft soap ..	..	..	..	5 lb.
Water ..	..	..	..	100 gal.

Since these washes are ineffective against the eggs of Red Spider, it is essential to apply them after the majority of the winter eggs have hatched, but before the mites begin to lay their summer eggs. The red winter eggs, which may be found on the spurs, around the buds, and on two- and three-year-old shoots, begin to hatch early in April and continue hatching till mid-May.* The mites from these eggs feed and lay summer eggs, mainly on the under-surfaces of the leaves, and the control of the pest is rendered difficult by the fact that the earliest batches of summer eggs are often laid before all the winter eggs have hatched.

Apples should be sprayed with lime-sulphur or liver of sulphur a week before the blossoms open, and if possible during warm weather. A pre-blossom lime-sulphur spray also has a fungicidal action. The ordinary post-blossom scab sprays (lime-sulphur) help to control Red Spider, and in severe cases may be used in addition to a pre-blossom spray, but it should be noted that some varieties, such as Stirling Castle, are very liable to sulphur damage.

Plums may be sprayed with liver of sulphur or lime-sulphur, but since it is necessary to apply the spray earlier in the

*Hatching has occurred much later this year—an exceptional season.

season (when many of the eggs have not yet hatched) the control of Red Spider is less complete than on apples. When 1 in 30 lime-sulphur is used on plums, spraying should be finished before the blossoms open, to avoid possible damage. It is not yet clear whether a post-blossom spray may safely be applied to plums. Experiments are in progress this year with the object of finding a safe concentration of lime-sulphur for post-blossom application to plums.

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PROCEEDINGS UNDER THE TITHE ACTS

The following Report deals with the business transacted in the Ministry under the Tithe Acts during the year 1928.

Total Amount of Tithe Rentcharge.—The total amount of tithe rentcharge charged on lands in England and Wales by the Tithe Acts, 1836, and the amending Acts, was £4,054,405. It is estimated that, by the end of the year 1928, this sum had been reduced by redemption, merger and other means to about £3,221,000. The particulars supplied by Queen Anne's Bounty indicate that at the end of 1928, approximately £2,019,906 tithe rentcharge was vested in them in trust for benefices, and £94,800 for ecclesiastical corporations. Information supplied by the Ecclesiastical Commissioners and Welsh Church Commissioners shows that approximately £279,000 and £207,000 respectively was owned by these bodies. The balance of the estimated sum of £3,221,000 above referred to, namely, £620,294, or such portion of it as is still payable, is held by various schools, colleges, charities and individual lay owners.

Redemption of Tithe Rentcharge.—The number of redemption cases completed in 1928 was 1,590, of which 336 were "compulsory" and 1,254 "voluntary," but in several cases rentcharges owned by two or more different tithe-owners were separately redeemed by these proceedings, and the total number of separate redemptions effected was 1,891.

The tithe rentcharge redeemed during the year comprised :—

- £4,445 payable to Queen Anne's Bounty in trust for Incumbents of Benefices ;
- £91 payable to Queen Anne's Bounty in trust for ecclesiastical corporations ;
- £729 payable to the Ecclesiastical Commissioners ;
- £423 payable to the Welsh Church Commissioners ;
- £2,482 payable to other owners ;

a total of £8,170, the whole of which, with the exception of £242 payable to "other owners," was redeemed in considera-

tion of cash payments, the tithe rentcharge amounting to £242 being redeemed in consideration of three annuities.

At the end of the year 1928 the number of compulsory redemptions in progress was 553, comprising areas owned by many thousands of small property owners.

The total amount of consideration money and expenses collected by the Ministry in connexion with compulsory redemptions in 1928, was £52,879 5s. 3d., and the number of property owners affected by these proceedings was 20,327.

Altered Apportionment of Tithe Rentcharge.—The number of cases completed during the year was 711, of which 538 were "voluntary" and 173 "compulsory." In the latter cases, tithe rentcharges amounting to £8,492 and charged on 40,242 acres, were re-apportioned among 1,075 landowners. The total of the expenses assessed upon these landowners was £3,025, the average cost being 1s. 6d. per acre, £2 16s. 3d. per landowner, and £17 9s. 8d. per case.

Merger of Tithe Rentcharge.—The total number of declarations confirmed by the Minister during 1928 was 256, and the amount of tithe rentcharge thus extinguished was £5,720 18s. 6½d.

Corn Rents.—During the past year, redemptions of corn rents, rentcharges, and money payments payable out of, or charged on lands in lieu of tithes, by virtue of any local Inclosure Act or other Act of Parliament, amounting to £289 6s. 1d. were completed, all of which were redeemed by cash payments. The total consideration of these redemptions was £5,885 14s. 0d. Last year four altered apportionments of corn rents were completed, and one case of conversion of corn rents into tithe rentcharge.

Other Transactions.—Other transactions effected during the year 1928, under the Tithe Acts and other Acts affecting tithe payments, included 29 redemptions and 30 altered apportionments of extraordinary rentcharge, and 9 cases of redemption under the London (City) Tithe Act, 1879, of tithe rate payable in the City of London. The number of cases of apportionment of annuities completed during the year under the Tithe Annuities Apportionment Act, 1921, was 42, and 1 case under Section 191 of the Law of Property Act, 1925.

During the year, two Orders were issued under Section 34 of the Tithe Act, 1860, in respect of lands which were charged with tithe rentcharge in two parishes. The Orders prescribed

the parish in which the lands were alone to be charged with rentcharge in future.

In addition, one Order was issued releasing an Order of Redemption of tithe rentcharge by annuity from the direction that part of the annuity payments should be accumulated by investment.

The fees and charges paid to the Ministry during the year ended December 31, 1928, in connection with the work under the Tithe Acts and other business referred to above were as follows :—

	£	s.	d.
Office fees	21,486	18	2
Inspection fees	407	12	6
Search charges	162	5	0
Charges for copies of, or extracts from, documents and tracings from the relative maps	1,490	3	9
	<hr/>	<hr/>	<hr/>
	£23,546	19	5

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MARKETING UNDER THE NATIONAL MARK

(1) **Eggs.**—Since February 1, the scheme has been in operation for applying the National Mark to eggs graded to the new statutory grade designations and packed in standard non-returnable cases. Participation in the scheme is voluntary but, if a packer wishes to apply the National Mark, he must comply with certain conditions which have been carefully drawn up and, in the interests of the industry, are being very strictly administered. The regulations and conditions under which the scheme is carried on are contained in Leaflet No. 6 on Egg Marketing Reform, which may be obtained free of charge on application to the Ministry. The number of egg packers authorized to apply the mark reached 104 by the end of February, 130 by March 31, 151 by April 30, and 174 by May 15. The registered packing stations are situated in practically every county of England, and there are five stations in Wales. Further applications are coming in, through the County Branches of the National Farmers' Union, for submission to the National Mark Egg Trade Committee. This Committee, composed of practical men, both producers and distributors, with Dr. Milburn of the Midland Agricultural and Dairy College as impartial chairman, makes a recommendation on each application to the National Mark

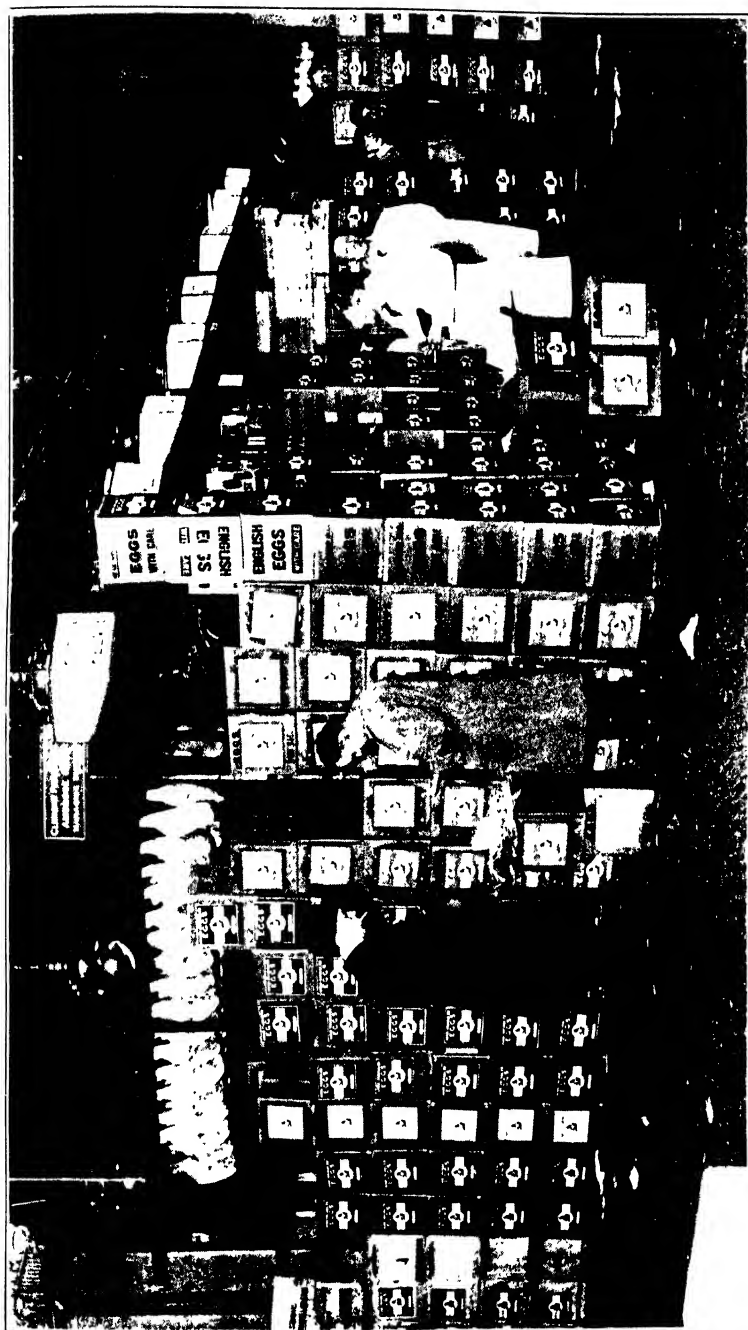
Committee, a non-technical, quasi-judicial body, under the chairmanship of Lord Darling, which is empowered, by law, to authorize packers to apply the National Mark, and to suspend or revoke such authorization in the event of non-compliance with the regulations and conditions. There is every indication that the number of authorized egg packers will soon exceed 200, and that their number will continue to grow.

For the results achieved to date, credit is due to the County Branches of the National Farmers' Union, some of which have done splendid work in propaganda and local organization. In some areas, County Agricultural Committees and their Officers as well as Women's Institutes, have also helped effectively. There has been, also, remarkable publicity, and a debt of gratitude is due to the agricultural, poultry and daily Press. The interest of retailers and consumers of eggs has been further stimulated by the organization of local National Mark Egg Weeks in important towns.

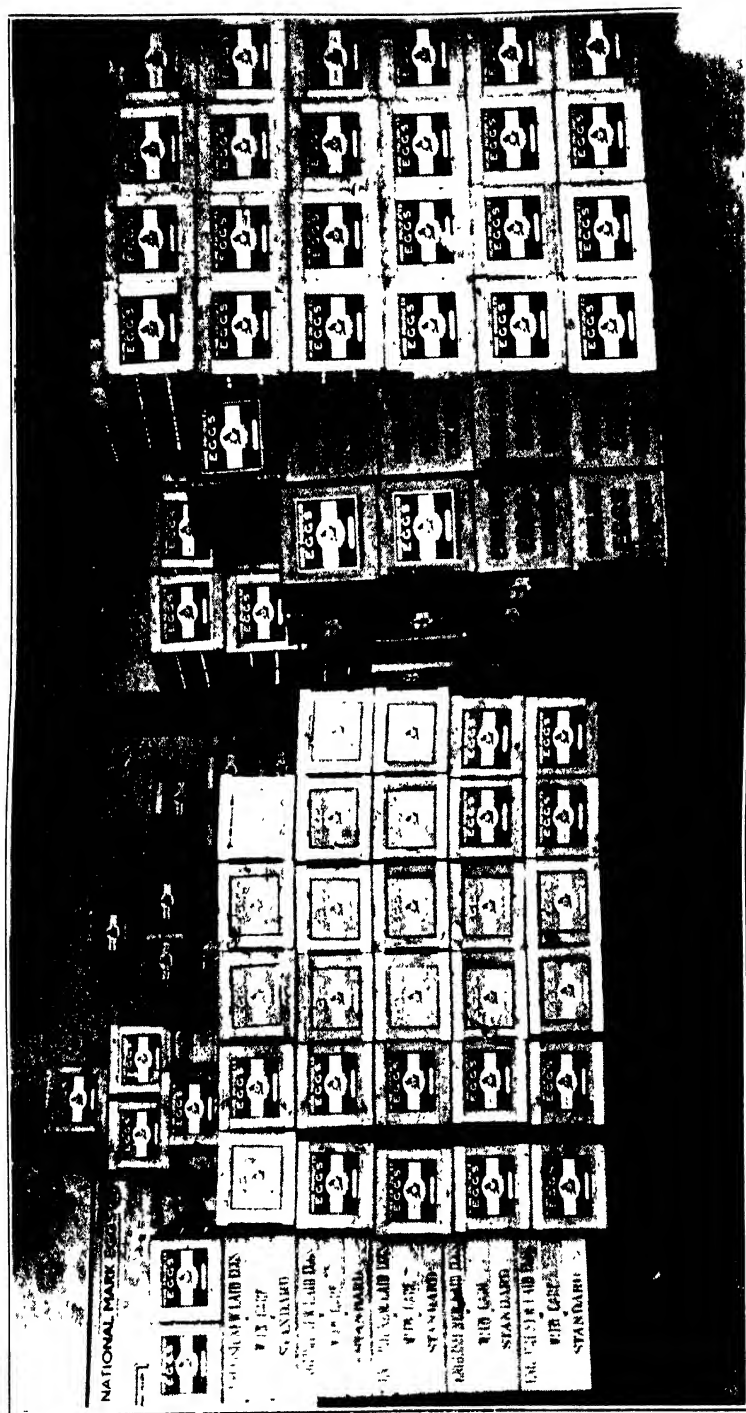
The various packing stations are of different kinds. Between 40 and 50 of the packing stations are co-operative or under some other form of producer control; a number are, or have been, auctions; many are run by country dealers, and some are controlled by large town distributors. A recent feature has been the number of town packing stations added to the list. These stations are owned by large distributing firms in consuming centres, and are generally managed with great efficiency.

The marketing of eggs under the National Mark Scheme, combined with the compulsory marking of imported eggs, has had striking results in introducing the home-produced National Mark eggs into quarters where previously dependence was largely placed upon imported eggs of good quality. A notable instance is the Metropolitan Asylums Board, London, which has specified National Mark eggs for delivery to them in contracts recently made for the supply of their institutions. These institutions comprise no less than 49 hospitals and similar establishments in London and the country. Similar action has been taken by numerous Boards of Guardians, and there is no doubt that their example will be followed throughout the country by public authorities who insist upon having a well-graded article of guaranteed quality.

It is also notable that at Smithfield, where prior to the introduction of the National Mark scheme, the quantity of English eggs regularly marketed was not large, the volume



Supplies of National Mark Eggs at the premises of Keevil & Keevil, Ltd., Central Markets, Smithfield, Saturday, May 11, 1929.
MARKETING UNDER THE NATIONAL MARK.



Supplies of National Mark Eggs at the premises of Nielsen, Pöhlke & Co. Ltd., Tooty Street, London. Saturday, May 11, 1929.
MARKETING UNDER THE NATIONAL MARK.

of National Mark eggs handled by the salesmen has become an important feature of their business.

The accompanying photographs give some idea of the volume of daily trade in National Mark eggs handled by two well-known salesmen at Smithfield Central Market and Tooley Street, London, respectively. These photographs, which were taken on Saturday, May 11, show standardization in the mass—an altogether novel spectacle so far as home produce is concerned. They represent, of course, only a fraction of the National Mark supplies that are daily passing through the great London wholesale markets.

There is abundant evidence throughout the towns and cities of this country that National Mark eggs are being taken exclusively by firms that previously handled only or mainly imported eggs. Furthermore, numerous wholesale firms and large multiple shop concerns will gladly handle National Mark eggs exclusively as soon as supplies can be assured in requisite volume.

The effect of this entry of home-produced eggs into new markets in our big consuming centres is necessarily being felt away back in the country districts, and the general price level has been influenced favourably. It is instructive to compare the monthly index number for egg prices in 1928 and 1929 respectively :—

MONTHLY INDEX NUMBER.		PERCENTAGE ABOVE 1913:			
	January	February	March	April	
1928	78	32	25	37	
1929	56	68	93	45	

The change in direction of the course of prices between January and February of this year and last year is significant. The favourable results shown on the above figures cannot, of course, be wholly attributed to the effects of the National Mark scheme and to the publicity with which it has been associated. There was the exceptionally hard weather in February and March, while, in the last week or so of April, the market was somewhat disturbed by the marking of imported eggs. Nevertheless, those best qualified to judge in the trade are satisfied that the National Mark scheme is materially influencing the market in favour of the producer.

It remains for English and Welsh egg producers to seize the opportunity which is now offered to them to make secure for National Mark eggs the position at the top of the market that has already been reached as the result of the scheme, and to meet the natural preference for home-produced eggs

in English and Welsh homes. *This position cannot be maintained by marketing ungraded English eggs, nor can the large and growing demand be met by small quantities of eggs marketed irregularly and unevenly from week to week.*

The supremacy of the home-produced egg can be maintained only by marketing eggs of first quality, carefully graded for weight and packed under the National Mark scheme. This is a matter that concerns every farmer. Egg production should no longer be regarded as an unimportant side of his business, but as one capable of yielding considerable profits if handled in an intelligent and businesslike manner.

(2) **Tomatoes and Cucumbers.**—The glasshouse section of the fruit-growing industry of this country has already made notable progress in the technique of preparing tomatoes and cucumbers for market. In the definition of grades and in the fixing of net weights and counts some degree of standardization has been attained. In addition, almost complete standardization of a limited number of package types has been secured. Tomato and cucumber growers are therefore in a position to derive advantage from the application of the Agricultural Produce (Grading and Marking) (Tomatoes and Cucumbers) Regulations 1929 to their marketing activities. By these regulations the Minister of Agriculture and Fisheries has defined grades, prescribed grade designation marks for graded home-grown produce, and drawn up such conditions as are necessary to regulate their application. Full details of the regulations and conditions are contained in Marketing Leaflet No. 10, which may be obtained, free of charge, from the Ministry.

In view of the extension of the National Mark Scheme to tomatoes and cucumbers, the Minister has approved the appointment of Mr. A. G. Linfield, Mr. John Poupart, and Mr. E. G. Shoults, to be additional members of the National Mark Fruit Trade Committee, who are responsible for the consideration of applications to use the grade designation marks prescribed by the Regulations prior to their submission to the National Mark Committee. In the first year, permission to use the Mark will not be granted to growers whose total area of land under glass devoted to tomato or cucumber culture is less than one-quarter of an acre (10,890 square feet) for each fruit, or to packers who are handling less than similar output equivalent. Separate authorization is necessary for the use of the Mark on tomatoes and on cucumbers. Up to May 21, the total number of growers authorized to apply

the National Mark to their produce was 64 in the case of tomatoes and 22 in the case of cucumbers. A large proportion of these growers are situated in the Lea Valley and Worthing areas, but many other parts of the country are also represented. The number registered to date is regarded as a very satisfactory start to this scheme, but applications for authority to use the National Mark continue to reach the Ministry, and there is every evidence that a considerable quantity of the fruits packed under the National Mark will be available on wholesale and retail markets throughout the summer. Arrangements are being made for suitable publicity to stimulate public interest in this new activity under the ægis of the National Mark.

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COUNCIL OF AGRICULTURE FOR ENGLAND

The thirtieth meeting of the Council took place at the Middlesex Guildhall on Thursday, May 9, 1929, at 11 a.m. The Rt. Hon. Lord Strachie (Somerset) was elected Chairman for the year 1930. Mr. R. G. Patterson, O.B.E. (Staffs.) was cordially thanked for his services in the chair for the year 1929.

Wool Marketing.—*Mr. Denton Woodhead* moved the adoption of the Standing Committee's Report on the Marketing of Home Grown Wool. He said that in January, 1928, the Committee had mentioned the matter in its Interim Report on Marketing, and had recommended co-operative action by farmers in the collection and sale of wool, and the abolition of some of the smaller markets. The result of further inquiry, in which the Committee had been assisted by brokers, auctioneers, scientists and wool buyers, was the present Report. Even as a by-product, wool was worthy of attention if a better price could be got for it when marketed in the best way. Indiscriminate crossing of sheep was bad for quality, and the Report recommended where possible the adherence to pure breeds or first crosses.

Wool buyers had complained of the way in which English wool was put up for sale, and the Committee had been told that the wool sorters in Bradford spent no less than half-a-million a year in making an extra examination of the fleeces for vegetable matter, such as the jute of packs and binder twine, and bracken, heather and so on. This sum might well, with greater care and thought, be transferred to the pocket of the producer. It was a very serious matter if such material, which would not take the dye and would not finish like ordinary

wool, got into the cloth. Only a few days back, his notice had been called to a case where vegetable matter went with the wool right through to a piece of navy blue serge which had to be sent back from the tailor where it was discovered. Tar and pitch were bad for marking sheep. The recipe of the British Woollen Research Association, Leeds, for marking sheep named in the report, and should be widely used by farmers in this country. It would be found to mark the sheep adequately and could be scoured out with the washing of the wool.

As to actual sale, the sheep farmer had no opportunity of studying the market, and the wool stapler knew every turn of it. Sale direct by farmers was therefore becoming obsolete, and it was much better to pass the business through to a wool co-operative society manager, who knew the trade. In the case of the Scottish Wool Society, as stated in the Report, the manager was an expert and he sold to buyers direct without going through the auctions. It was very essential that wool societies should be managed by experts. It was necessary also, in setting up wool societies, to have a good working number of fleeces at the beginning, and after a few years to have at least 100,000.

Mr. R. P. Allsebrook (Leicester) said that he endorsed all *Mr. Woodhead* had said. He was Director of the Wool Grading Co-operative Society at Banbury, and the quantity of wool they got was too small. They wanted more of it and of fewer varieties.

Mr. Chas. Roberts (Cumberland) asked what happened to these Marketing Reports. He was anxious that they should not be pigeon-holed. This one, he thought, was of conspicuous merit, and he would like to know that it was circulated. The Scottish Wool Growers were doing good work in the North of England and they could do with more members. He could circulate a good many copies of the Report himself. *The Chairman* gave information to the effect that if the Report were approved it would be printed by the Ministry and circulated to the County Agricultural Committees, who would be asked to see that the responsible County officials got copies, as well as any important bodies of farmers who were interested in wool questions. The circulation of previous Marketing Reports had been as follows : Fresh Milk Report, 972 ; Live-stock and Meat Report, 2,136 ; Home Grown Fruit, 2,196 ; Canning of Fruit and Vegetables, 2,108 ; and Eggs, 2,244. *Mr. Dallass* said he did not think such circulation sufficient. He thought the Reports should get wider publicity. Farmers in all

parts of the country should have an opportunity to read them.

Mr. G. G. Rea, C.B.E. (Northumberland) considered that the Report rather under-stated the importance of wool than otherwise. In some Counties it was more than a by-product; it was one of the mainstays of farming. He was not sure that there was not a danger of too many societies being formed. It was better for them to be centralized so as to hold the bulk of wool available for inspection by purchasers. He bore tribute to the excellent management of the Scottish Wool Society. He questioned the Report's statement that skin wool formed as much as one quarter of the total clip; or, if that were correct, that it was a fact that was not of very considerable importance to the wool grower. The clip of wool, he said, was affected by the soil and the climate. In Northumberland, Cheviot sheep grew a different quality of wool from Cheviots in the north of Scotland. No doubt the same applied to other breeds. There were certainly too many breeds and crosses. It was time that the old breeds kept for sentimental reasons were done away with.

Mr. Clement Smith (East Suffolk) said he hoped that the Report would get in the hands of every wool grower in the country. He had been selling his wool co-operatively for a very long time. The main objections to co-operate action were (1) that farmers did not know what they were going to make for their wool, and (2) that they had to wait for their money. His answer to (1) was that farmers could always put a reserve on their wool, but that it was not necessary if they left it to the broker to get them a fair market price. As to (2) there was no waiting for money, as societies paid about 75 per cent. of the value of the wool immediately it came into the depot.

Brig.-Gen. H. Clifton Brown (West Sussex) also asked for more publicity for the Reports. He said he would like to move that individual copies should be sent out to the County Agricultural Committees to distribute to each member and official, and that copies be sent to wool marketing societies and others interested. This Report was of the essence of agriculture and the highest form of agricultural education. The Government should, therefore, give it more publicity. *The Chairman* said he would be ready to take a motion from the honourable member after the Report had been adopted. *Sir Francis Acland* seconded Gen. Clifton Brown's suggestion. The Kent Wool Society, he said, had been the first of its

kind, and that and the other societies were founded after a great deal of hard work by the Agricultural Organization Society. Sir Leslie Scott was the person who, as Chairman of that Society, had devoted much intensive work to getting the Kent Society formed. *Sir Francis* brought up three points : (1) that the method in which the fleeces were prepared ought to depend on contract and not on chaos, (2) that there should be some supervision and periodical inspection by a central body to make sure that the management of a society was sound, and (3) that societies should not be formed for areas so small that they could not get a proper minimum number of fleeces.

Mr. J. E. Quested (Kent) said he was one of the first who had assisted the Kent Society. As regards mixed lots of sheep the farmer could not help it. The public had been educated up to small joints, and to obtain them you must have crosses. The number of grades hardly mattered if the grader was up to his job. They could all be sold without difficulty. As to the pitch marking, a conference at Bradford some five or six years ago had agreed to go into the question, but he had not since heard anything of it until this Report. In Kent they were dealing with only about one-third of the clip. Some farmers would "sit on the fence" and it was very hard to educate them. The National Farmers' Union had called a conference some weeks ago, and he had been asked to be Chairman of the Committee set up as a result of that conference. He hoped that the Report would be the means of bringing more farmers into the wool societies.

Lord Stradbroke, Parliamentary Secretary of the Ministry, added, on behalf of the Ministry, a word of congratulation for the excellent Report placed before the Council. It would be of very great assistance to the marketing of wool in this country. The Ministry would certainly be ready to carry out the Report, and to join with the National Farmers' Union in arranging grades for the better-known kinds of wool and employ the National Mark on them.

Mr. Woodhead briefly replied, pointing out that 25 per cent. skin wool was an official figure and was borne out by trade witnesses. As to the Leeds Research Association's new marking for sheep, if it would not stand the weather it did not serve its purpose. He had been inquiring that week at a mill in the West Riding as to whether they used English wool. The reply was that they used none, and could not be bothered

with English wools because they were not properly graded. He was sure the Committee would be glad to put at the disposal of the National Farmers' Union any information which they had gathered in the matter.

The Report was then put to the meeting and adopted.

Publicity of Council's Reports.—*General Clifton Brown* moved :—

“That the Reports of the Marketing Series of the Council, of which the Wool Report was the latest, should be printed in sufficient numbers to supply the demand that was likely to arise for copies.”

Mr. W. R. Smith seconded, and stated that the matter might usefully be referred to the Standing Committee itself to deal with.

Gen. Clifton Brown agreed, and the suggestion that the whole question of publicity for the Marketing Reports be referred to the Standing Committee was agreed by the Council.

Wheat, Barley, and Oats Marketing.—*Mr. Woodhead*, on behalf of the Standing Committee, presented its Report on the Ministry's Report, Economic Series No. 18, on the Marketing of Wheat, Barley and Oats in England and Wales. He did not wish to go very much into the details of the Ministry's Report as the Standing Committee had not yet considered the subject of Cereal Marketing. Their Report merely commented upon the Ministry's Report with a view to recommending farmers and agriculturists to read it. *Mr. W. B. Taylor* (Norfolk) suggested that copies of the main Reports should accompany the Standing Committee's Reports but, coming down to the recommendations in the main Report, he considered that the number of sellers of grain on the market ought to be reduced. He would like to know how this was to be secured as it seemed to be the crux of the whole question. He hoped that the Standing Committee, when it took up the question, would look into it as well as they had looked into the wool question; in his view it was vital to arable agriculture. *Mr. A. E. Bryant* (Bucks) asked that the Council might accept the Standing Committee's Report, and considered that the main Report should be circulated. *Mr. R. G. Patterson* (Staffs) said that he hoped a detailed Report in regard to wheat would be ready to be laid before the next meeting of the Council. It was a very difficult matter to sell an article to

an unwilling buyer, and as long as merchants and millers bought, as they did to-day, mostly imported wheat, over the telephone, they would not trouble about English wheat presented on the various markets. The remedy was to compel millers to use a certain quantity of English wheat in their flour. The use of English wheat in bread for the Forces was a step in the right direction, and he wished to express his appreciation of the action of the Government in this matter.

Mr. Allsebrook pointed out that against the fact of diminished prices after harvest had to be put the diminished quantities, through loss of moisture and through loss by vermin, which could be put on the market in the spring. The greater use of wheat for poultry should not be overlooked. The other day he was offered 42s. a quarter for his wheat by a miller, and soon after 46s. for it for poultry food.

The Report was adopted by the Council.

Standing Committee.—The existing Standing Committee consisting of :—

The Rt. Hon. Sir Francis Acland, Bart.	Major F. H. Fawkes.
A. W. Ashby, Esq., M.A.	James Hamilton, Esq.
Lt.-Col. Sir Merrik Burrell, Bart., C.B.E., J.P.	Sir A. G. Hazlerigg, Bart.
Lord Clinton.	Sir Douglas Newton, K.B.E., M.P.
G. Dallas, Esq.	Alderman R.G. Patterson, O.B.E.
J. Donaldson, Esq.	C. C. Smith, Esq., J.P.
G. Edwards, Esq.	Lady Mabel Smith.
	W. R. Smith, Esq.,
	Denton Woodhead, Esq.

was re-elected. *Mr. G. G. Rea* was elected in the place of Capt. E. T. Morris, resigned.

National Milk Publicity Council.—*Mr. George Dallas* moved the following resolution on behalf of the Standing Committee:—

“That the Council of Agriculture for England realizes the importance of the excellent work which is being done by the National Milk Publicity Council in promoting the welfare of the dairy industry, and in helping to raise the standard of national health by encouraging the demand for liquid milk. It would accordingly like to see its work continued and extended, and requests that suitable grants should be made to the Council for the purpose from the funds of the Empire Marketing Board.”

Mr. Dallas said that the National Milk Publicity Council was the only organization in the country to-day which was spending its time, money and energy on advertising the uses of milk and advising people to drink milk. The Empire Marketing Board were advising people to buy Empire goods and were spending large sums on advertising them. These sums were

put up by the British taxpayer and amounted to £1,000,000 per annum. He had no objection to spending money to help the Dominions provided that it did not endanger the interest of our own home producers. The Empire Marketing Board should use the hoardings to advise people to drink milk, and they should not require £1 from the producers for every £1 that the Board itself put up. They did not make such a condition with the Australian wool producers, and he thought it unfair that this country should make all the contribution. The Milk Publicity Council was doing some very good work. Our producers were putting on the market to-day the cleanest and purest milk of any producing country in the world. The Council was therefore doing good to the children and helping to bring along a better generation. Milk publicity was being carried out in Scotland by the Empire Marketing Board, and Scottish producers were not contributing.

Mr. Robert Hobbs, in seconding the motion, testified to the encouraging nature of the experiments that had been carried out in feeding children with milk. The Empire Marketing Board had not denied help in an actual experiment carried on for several months in one of the lowest-lying villages in Oxfordshire, where the children were below the usual standard of physique. During the whole of the very hard winter there had been no serious illness amongst them. The school attendance was higher than for the whole County, and during the seven months was something over 97 per cent. The weight and height of the children had considerably increased. He would like to see similar experiments in every county in England. *Mr. W. R. Smith* said it seemed that the statements made by the mover were matters which called for close investigation. He was well aware that the Dominions themselves agreed to recognize the claims of Home Grown Produce first when it came to publicity for Empire marketing. He thought that to the resolution should be added the request that the Ministry would investigate the point, and ascertain what justification there was for the Empire Marketing Board placing a barrier in the way of home production. It was useless for a producer to keep on producing unless there was an outlet for his goods. Milk was one of the best lines in agriculture, and it should be a matter of national concern to put no impediment in the way of full and proper consumption.

The resolution was put to the meeting and carried unanimously.

Sheep Scab.—*Lt.-Col. Sir Merrik Burrell, Bart.* (West Sussex moved the following resolution :—

“That this Council deplores the fact that there is no progress being made towards the eradication of Sheep Scab from this country.”

Sir Merrik gave the history of Sheep Scab legislation and regulations and discussed their effectiveness at various times. The annual average of reported cases from 1870 to 1904 was 2,086. In 1907 the Board of Agriculture had reduced the figure to 751, and in 1914 to 226. Since the war, the figure had risen again—to 743 in 1928. The position was that the Ministry and its officials could do no more than they were doing unless and until their efforts were backed by the agricultural community. It was the duty, he considered, of this Council to express its opinion on this subject, and it was the duty of every individual member of the Council to go back to his county and see that the regulations were carried out and that county public opinion was aroused. *Mr. Quested* seconded the resolution. He knew that the Ministry had prosecuted in 53 cases in 1928. In three of them adequate fines were imposed, but in the remaining 50, the average was £3 2s. 3d., and in Wales was £1 9s. 3d. That was not the way to stamp out Sheep Scab. The National Farmers' Union had taken up the question strongly and were suggesting that there should be travelling shepherds who could look about and see where sheep were affected with scab. He did not see at the moment how the thing would work, but the Ministry would, no doubt, consider it. The present position was scandalous. *Mr. Geo. Edwards* also spoke strongly in favour of the resolution and was followed by *Mr. Edwin Peat* (Derby), *Mr. Clement Smith* and *Mr. W. W. Sampson* (Dorset), *Mr. J. P. Terry* (Gloucester), *Mr. G. G. Rea*, *Mr. R. P. Allsebrook* and *Sir Walter Berry*, all of whom spoke in favour of the measures against scab being more rigidly observed. Double dipping and the precautions against movement were essential where scab actually existed. In other counties care should be taken to keep scab out. *Mr. Rea* advocated dipping twice per annum, as was practised from about 1907 or 1908 till 1914, as it afforded protection, the sheep being less liable to contract the disease even when in contact with affected animals.

Lord Stradbroke expressed the Ministry's gratitude to *Sir Merrik Burrell* for appealing to flockmasters to carry out the regulations. The three things chiefly necessary were (1) prompt reporting of suspected cases ; (2) prompt application of the

regulations by Local Authorities ; and (3) efficient dipping by owners of affected sheep and of those in the affected areas. Every County Authority could require a second dipping of sheep if it wished. In 1928 no fewer than 168 outbreaks were not reported : that was 22 per cent. of the total.

Mr. Hall (Herefordshire) said he did not think the resolution went far enough : universal double dipping within 14 days seemed to him to be necessary. *Sir Merrik Burrell*, in conclusion, said that if counties that were clean would see that all sheep coming in were double dipped immediately on entry that should be sufficient. Certificates from another area that they had been double dipped should not be accepted. Dipping should be at the right strength for the proper time and sheep should be immersed. It was good for the general health of the sheep. Twice dipping was not double dipping ; he thought it would do good if the records of movement of animals were looked at more frequently by those in authority.

The resolution was put to the meeting and carried.

World's Poultry Congress.—*Dr. Charles Crowther* M.A., Ph.D., moved :—

“ That the Council welcomes the opportunity that the forthcoming World's Poultry Congress and Exhibition at the Crystal Palace will provide for stimulating the home poultry industry, and the export trade in pedigree birds.”

He said that as a member of the General Purposes Committee of the Congress, and as director of Harper Adams College, the largest poultry educational and research centre in Europe, he gladly took over the responsibility for this motion from *Mr. George Dallas*, who had been called away. The Congress was to be in July, 1930, and arrangements for the attendance of a large number of foreign delegates were already in progress. They were coming at the direct invitation of the Prime Minister, and the Ministry of Agriculture was to be responsible for the Congress. Its success would turn very largely on the support given it by Local Authorities in this country and persons directly interested in agriculture. He would like to think that such a success would be achieved that our visitors would go home thinking that this country was not likely any longer to remain the saucepan in which any outsiders could break eggs and make omelettes for us—but that the British poultry industry was developing so fast that they must abandon efforts in competition. *Mr. W. R. Smith* seconded, and the motion was put to the meeting and carried.

APPENDIX

REPORT BY STANDING COMMITTEE OF COUNCIL OF AGRICULTURE FOR ENGLAND ON THE MARKETING OF HOME-GROWN WOOL

(1) We referred to Wool in our Interim Report on Marketing, dated January 19, 1928. We then recommended an extension of co-operation among farmers and fewer and bigger wool auctions. We put forward those two points as being the chief desiderata in the improvement of wool selling. Closer inquiry into the situation has confirmed this, and has revealed a position which shows it to be absolutely necessary for farmers to combine together for the better sale of their wool if they wish to make the most of this valuable by-product. Generally speaking, farmers have not paid the attention to wool production and selling that the subject deserves, and many suffer considerable loss through old-fashioned methods of selling wool "at the door" or at small local auctions, and through the poor presentation of their clip.

(2) We have interviewed representative persons of several interests concerned in the production and sale of wool, wool selling societies, wool brokers, scientists, research workers, etc., and have made such inquiries as we thought necessary in order to form a better judgment on the problem. Our inquiries have been directed to the selling of clipped wool, the selling of skin wool, which may be as much as one-fourth of the total home-grown clip, not affecting the farmer to any great extent.

(3) Wool, as grown in this country, is a by-product in the production of mutton and lamb, and farmers cannot readily measure the costs of production attributable to it, because these are not easy to set out apart from those of the meat. That wool is now a product of some importance is seen from the fact that an average fleece weighs about 6 lb. and at 1s. 6d. a lb. this gives a return of 9s. per sheep per annum. This is a figure which is merely suggestive of the value of an average fleece at the present time; the maximum would be much more.

(4) There is little doubt that the quality of the fleeces of most of our breeds can be greatly improved by care in breeding. Farmers may have hung back from advance in this direction because of apprehension that by improving wool they deteriorate the value of the mutton and of lamb. Up to the present they have attached too much importance to this apprehension. Science has not found any justification for it, and we recommend in a later paragraph that definite steps be taken to improve the quality of the wool produced in this country.

(5) Then the question of presentation on the market; much of our wool is presented without any knowledge of the requirements of buyers, or of the proper methods of presentation or of grading fleeces so as to obtain the best prices. The wool buyer has to be attracted to the product in the same way as any other buyer, and if all home-grown wool is shown properly prepared and graded on the larger market, it will secure the full attention its qualities merit. This matter of proper presentation we will also deal with in later paragraphs.

(6) On the general subject, we will quote the pamphlet on "Wool Research and the Farmer," issued by the British Research Association for the Woollen and Worsted Industries, Torridon, Headingley, Leeds. It states that "There is probably no agricultural commodity about whose true value or use the farmer is more ignorant or of which the sale is conducted for the most part on such haphazard lines," and again, "The ignorance of the farmer as to the manufacturers' requirements, his lack of interest in many cases in a by-product, and

the complicated economics of the production of a by-product, have resulted in a British wool clip in which the margin for improvement is very wide." It must be remembered, however, that changes of fashion are often responsible for changes in manufacturers' requirements and a farmer, if he did grow sheep for a special wool, could not foretell these and clear himself of possible loss should that wool cease to be so much in request.

(7) Dealing first with improving production, the evidence of science is that wool can be improved in quality by a process of selection, rams being chosen for wool characteristics as well as for meat. Such selection should be made within the breed or by crossing with another breed of better wool and not inferior mutton character. Second and third crosses and indiscriminate mixing of breeds must lead, not only to very uncertain results in mutton and lamb, but to confusion in qualities and value of wool. The present tendency to take wool from any cross or mixed breed that happens multiplies quite unnecessarily the classes of wool placed on the market, and tends, through the presence of inferior qualities, to depress prices for better qualities. There is little doubt that this factor is one of the chief reasons for the poor wool prices that obtain in many parts of the country. Lots presented for sale are too mixed in quality, and there is too much inferior wool in them.

(8) The object should be to bring a larger percentage of the clip nearer to the best for a particular breed and locality. The variations of wool qualities within a pure breed are truly surprising. In one pure breed observed by the biologist of the British Research Association, the variation in four sheep was expressed by the figures 30, 26, 20 and 18. It is a fact, also, that good fleeces of some breeds can be and are classed in other categories which bring them higher prices. For instance, first-grade wool of Welsh Mountain sheep can be sold as "Fine Shropshire"; good Blackface as Swaledale, and so on. It should be possible, therefore, to grade up a very considerable part of the clip of particular breeds into higher categories. In this endeavour specific objects may be aimed at, *e.g.*, the elimination of the coloured hair and wool in the fleeces of Suffolk and other breeds, or the elimination from mountain sheep of "kemp"—the dead white hair in the fleece which will not take dye in the cloth—this latter object is, as a matter of fact, now being examined at Bangor University College in association with the British Research Association for the Woollen and Worsted Industries; or the object may be simply to get better and bigger fleeces from the sheep of a particular breed. In this connexion it would be an advantage if more attention were paid to wool in the judging of breeds of sheep at shows, and the practice of exhibiting rams both for show and for sale unnaturally coloured should be strongly discouraged.

(9) The question of improving production also covers that of a possible limitation of breeds and crosses. There are about 34 well-known and distinct breeds of sheep in the country and many cross-breeds. Each breed and cross produces several different grades of wool, and each fleece supplies several different qualities of staple. The number of classes of wool which have to be dealt with by the market, therefore, amounts to some hundreds. It will surely be to the benefit both of the producer and user of wool if the variety of supplies is reduced to the limits of the real requirements of the market. The producer can, however, only accede to reductions which do not conflict with his other object of supplying certain qualities of mutton and lamb. It would help if the Wool Trade will state in precise terms its reasonable requirements so that the farmer can have something

definite to go upon in breeding for wool. There is much inferior and poor quality wool which could well be substituted by better, and it is obvious that business could be simplified if fewer classes of wool were offered on the market. This statement might be drawn up by a Committee of the Trade in conjunction with the Wool Breeding Council for Great Britain, or by the British Research Association already mentioned.

(10) To deal now with the question of the preparation of wool for market. There appears to be a preponderating opinion among co-operative societies and others in favour of the farmer selling his wool unwashed, i.e., in the greasy state, because the higher prices obtained for washed wool are not usually sufficient to compensate for the cost of cleaning and the loss of weight in the fleece. It has been put to us also that the grease if left in the wool helps the manufacturer in his cleaning processes and saves him a certain expense in washing agents. It may be that, properly considered, greasy wools are worth more to the manufacturer in relation to washed wool than the present commonly accepted price differences show, but that is a technical matter on which we have not sufficient data to form a judgment. What appears to be clear is that if wool is sold washed it should be properly washed, and that not more than 9 to 12 days before shearing, and at shearing it should be quite dry. If a longer time is permitted to elapse, the grease may have returned to the wool and it may not be able to escape being classed as "greasy." Dirty wool, with admixture of earth, sand, or, what is worse, strands of vegetable matter, bracken, heather, grass or dung, tar, pitch, etc., always must fetch a lower price. The vegetable matter is sometimes very difficult to remove from the wool, and if it remains in it may easily spoil the finished cloth. It is said of English wool in general that it contains more incidental impurities than most other wools presented on the market, and usually costs 25 per cent. more for the wool sorters' work in cleaning, as it needs two sortings, first for getting out the impurities, and second for sorting out the different kinds of wool. That may, of course, be an exaggerated generalization, but it is said; and there is no doubt plenty of room for improvement. In the matter of string admixture got from tying fleeces up with binder twine and using jute-made sheets for packing, we are told that it costs the Bradford trade half a million pounds sterling a year for extra labour. If that is so, a large part of this sum must be coming out of the farmer's pocket. We understand that the British Research Association is now experimenting with a pack which is free from the objection named, and is strong enough for the hard usage and wear to which wool packs are submitted.

(11) The question of the use of an alternative for tar, pitch and other objectionable marking for sheep has also been considered by the Research Association. Tar and pitch are obviously bad as they are very difficult to scour out, and, besides involving a loss of good wool where the tarred locks have to be cut away, cause larger losses to the manufacturer because the small pin points of tar cannot, even with the most expert sorting, be eliminated. In the finished cloth or felt they show as dark patches up to the size of sixpences, and frequently spoil the piece of cloth or other material for the best uses. The Association has recommended, after much experimenting, the following mixture for use in this country:—

Wool fat	45 parts by weight.
Lime blue	5 " " "
Barytes	20 " " "
Emco (light paraffin spirit) ..	25 " " "

(12) In addition to these precautions, the wool, in being prepared for the market after shearing, should be separated and dealt with as follows. The daggings, the stained and discoloured wool, and the odd pieces should be put in separate packs, and the rest of the fleece rolled up separately. This operation should be done on a smooth, flat surface. Each fleece should be spread with the flesh side down, folded in from the sides, rolled from tail to neck, and tied with the bands made by twisting the neck portion of the fleece. All fleeces kept on the farm should be carefully stored in dry places, clear of all walls, covered to keep out dust, and protected from rats and mice.

It may be useful here to mention that the farmer is not concerned with any sorting of wool. He deals with fleeces only. These can be graded and classed before they pass out of his possession by sale but the sorting and matching are matters for the user or the merchant after the breaking up of the fleece.

(13) Coming now to the actual question of marketing, the existing methods were outlined in the Report by the Ministry on Wool Marketing, Economic Series No. 7, issued in 1926. The Committee is indebted to this report for much useful information. The three usual methods of selling are :—

- (1) Private treaty sale to dealers ;
- (2) Sale through wool auctions ;
- (3) Private treaty sale to users or manufacturers.

(14) As regards (1)—private treaty sale to dealers—taking sales over a series of years, this must obviously be an unsatisfactory method, as it takes place without competition and in circumstances which make it unlikely that the farmer can count on getting full value for his wool. The buyer is usually an expert in wool, which the farmer is not and the commodity is apt to vary considerably in value from year to year and clip to clip. Be it never so straightforward a deal, the purchaser has to put himself safe in buying a mixed lot of wool, which he cannot go through in detail, by offering rather less than what seems to be a fair average price for the whole. The price of any commodity is, moreover, what the seller will take, and, without a proper guide as to value at the time, which no grower is likely to have, it seems to us that, however good a bargainer, the grower must almost inevitably lose.

(15) As regards (2)—sale through wool auctions—this method may be free from the most serious disadvantage of method (1), though if the auction is a small one with few buyers not buying freely, the position of the farmer as seller may be but little improved. It is different at the larger auctions where buyers from many sections of the trade and for all classes of wool assemble. Where these conditions are best fulfilled, there should the ordinary seller take his wool or have it taken. For this reason, we unhesitatingly recommend the London auction sales over all others. Sale by auction at the local headquarters of any co-operative wool society, while saving transportation costs, would not be sufficiently attractive, in our view, to secure the presence of a majority of the largest home and foreign buyers on the markets. A co-operative society selling wool in London can do so by sending up a 25 per cent. sample, if the parcel is over five bales, and it can instruct its broker to stand out for a particular price, or the broker, knowing his client, will not sell at a price which he himself deems unsatisfactory. Wool can nearly always be held without much risk of deterioration, though the costs of storage have to be considered. The chief costs involved in sale to London are transport, commission and storage. Transport from distant parts is unlikely to be more than $\frac{1}{4}$ d. per lb., broker's commission varies from

1 to 2½ per cent. according to whether storage, insurance, etc., are included or not, so that the extra cost attached to selling in London is small compared with the better price that may be expected. There is reason to think that the more home-grown wool is shown on the London market, the more it is sought after by home and foreign buyers for the special purposes for which it is suitable. The quantity of home-grown wool so exhibited in London has increased considerably since the war and within the same period the exports of home-grown wool from the United Kingdom have advanced from 22 million lb. in 1920 to 62 million lb. in 1927, and in 1928 stood at the figure of 48 million lb. which is some indication of the strength of foreign buying.

(16) As regards (3)—direct private treaty sale to the user or manufacturer—this method probably offers a very good price to the producer in those cases where the manufacturer comes to him because he has just the quality of wool the manufacturer's trade requires. Such cases are, however, comparatively few, and other sales of the kind take some of the colour of the method described in (1). We, therefore, do not recommend it as a general rule, except where the grower is quite sure that by selling that way he is getting as good or a better price than he would through the auction sales. In this connexion, it is noted that the Scottish Wool Growers, Ltd., sells practically all its wool direct to users or manufacturers.

(17) At this point emerges the important question of whether the farmer is better advised to sell his wool through London on his own account, or whether he should do it in conjunction with other farmers. There is, fortunately, sufficient evidence existing on which to form a judgment in this matter, without having to rely on that from other countries where co-operative wool selling may be carried on under conditions widely differing from those in this country.

(18) For many years, it has been the practice of certain agricultural co-operative societies to market the wool of their farmer members co-operatively. In these cases, the practice has been adopted almost solely for the purpose of saving railway rates and other charges by bulk consignments; there has been very little effort in them to improve production, to grade collected fleeces, or to discover the best possible means of marketing. More recently, however, i.e., within the last nine years, there have been efforts made to sell wool by large co-operative societies formed wholly and solely for that purpose. These societies grade, bale and press the wool or otherwise prepare it for proper marketing, and contrive to give the farmer an advance of about 75 per cent. of the expected value of his clip after it has been so prepared. There is no doubt that, speaking generally, their efforts on behalf of the farmer have so far been highly successful. It happened last year, however, apparently through the circulation of incorrect trade information, that one or two of the five such wool societies now operating suffered a temporary set-back. The price of wool which had been high at the beginning of the period of wool sales dropped unexpectedly soon after. The societies—and private farmers—who did not sell their wool at the beginning of the season were unable to share the high prices, and, where sales of wool were forced when the market was low had to sell considerably below them. For the most part, the societies were able to hold their wool till prices returned nearer to their former level. The occurrence has been quoted as an argument against wool societies, but it does not seem to us in any way to detract from their value. Certainly, a few farmers who did not send their wool to societies last year were able to and did make better prices, but that is not likely to happen often, and still less as the organization of the societies becomes more perfect.

(19) It will be seen, then, that a co-operative wool society can help the farmer in the following among other ways:—

- (1) by giving assistance and advice as to the best means of preparing his clip, and as to better breeding for wool;
- (2) by grading the fleeces for London, and by pressing, baling and sending them there in quantity for each grade so that the large home and foreign buyers of wool are interested;
- (3) by paying an advance of about three-quarters of the estimated value of the wool immediately on receipt of it;
- (4) by arranging with a trusted broker for the best possible selling of wool in probably the finest market in the world.

(20) It is obvious, however, that no co-operative venture of the order of a Wool Society will be able to succeed quickly and certainly unless it is assisted by strong voluntary effort at the beginning and taken up with assurance and faith by the wool growers. In our view, growers should, from the start, contract with the Society for it to dispose of all, or a definite part, of their wool over, say, a period of three years. It is necessary to its stability as a selling organization that a society should have its members solidly behind it, and that those who share the advantages of its operation should definitely contract with it, their contracts being enforced, if necessary. The fact that the existence of a wool society in a district serves to keep up prices in that district is the more reason that all the farmers should become members and make it still more powerful.

(21) We pass now to an examination of the position of existing wool societies. Only two of them, the Scottish Wool Growers' Society and the Eastern Wool Growers, appear to have in operation a system of contract; the former as purely a voluntary system, though definite advantages are offered to contracting farmers, and the latter as an obligatory one.

(22) *The Kent Wool Growers, Ltd.*, is the oldest of the wool societies. It dates back to 1920 and owes its success in early years to the energy and perseverance of a few pioneer agriculturists. In 1920, its first year, with 75 members, it handled 25,000 fleeces, for which it obtained £12,500 in net sales at a cost of management of 1½d. a lb. In 1928, its members numbered 1,022 and it handled over 209,000 fleeces, for which it obtained a net sum of £127,349 at a cost of management of ¾d. a lb.

The figures submitted to us by this Society show that the prices obtained on its behalf in London are substantially greater than those given locally. The local average price is usually in the nature of a flat rate, while the Society's average figure is founded on a big range of prices. The fact that there is this range, examples of which will be quoted, should in itself be sufficient to put the wool grower on his guard against local selling and decide him to join a society.

In 1925, the average price obtained by the Society for washed Kent ewes and tegs was 16½d.; the local average price was 15d. In 1926, the average price of washed Kent ewes' and tegs' wool was about 16d.; the local price was 14½d. In 1927, the average price for the same grades of wool was about 20d.; the local price was 16½d.

Greasy Kent teg wool in 1927 gave the Society a return of 18d. per lb., against the local price of 14d. In the case of lambs' wool average prices for 1925, 1926 and 1927 were respectively 15½d., 15d. and 16½d., the local prices were 12d., 11d. and 13½d. It may be seen from the following prices that even in 1928, when prices slumped in the middle of the season and were supposed to show up co-operative societies selling badly, the prices obtained by the Kent Society were on the whole good ones.

		1928		
		Highest	Lowest	Average
		d.	d.	d.
Washed Kent Ewes	..	23	16½	19½
" " Togs	..	24½	19	21½
Greasy " Ewes	..	21½	14½	17½
" " Togs	..	20½	17½	19½
Washed half breds	..	25½	24	24½
Greasy " "	..	21½	18	20½
Washed South Down	..	26	25	25½
Greasy " "	..	21½	19½	20½
Lambs' wool	..	20½	17½	19
Locks	..	12	9	10

The area of the Kent Society seems to be exceptionally well-favoured for obtaining full advantage from co-operative sale. The breeds of sheep are few; fleeces can be easily sent to the central depot; and the society is served by a firm of wool brokers in London which has watched its interests successfully for the whole period of its existence.

As to its trade methods, the society obtains advances from the bank on the credit of the wool received, and pays immediate instalments to the farmer up to 75 per cent. of the value of his wool. It has to be remembered that the interest on the sum borrowed is a charge which the farmer must meet in the price he receives and is, as a matter of fact, included in the Society's costs which last year and for several years past amounted to ¾d. per lb. The Society takes all kinds of wool presented, and sends farmers the sheets in which to pack it. On arrival it is graded by an expert grader specially employed during the months in which the clip is being received. A 25 per cent. sample is sent to London except where the parcel is less than five bales, when the whole consignment is sent. The 25 per cent. appears to be a concession to the usual requirement of the London Wool Sales that all the wool sold must be available for the inspection of buyers.

One effect of the Society's existence has been to eliminate local wool auction sales. Though it has been successful, it has needed hard work, enthusiasm and good organization over nine years to make it so. We think it would be still more successful if a system of contracts with growers were adopted. Instead of having the support of one-third of the growers of the county it should have them all and so dominate the Kent selling interests to the benefit of producers.

(23) *The Southern Wool Growers, Ltd.*, operates over a much larger area than any of the other three societies in England. Its counties, placed in order of importance from the Society's point of view, are as follows: Sussex, Hampshire, Wiltshire, Somerset, Devon, Gloucester, Surrey, Berkshire, Hereford, Cornwall, Dorset, Shropshire, Oxford, Hertfordshire, Essex, Kent, Cambridge, Lincolnshire, Leicester, Northampton, Monmouth, Brecon, Glamorgan. It deals with the wool of a great variety of breeds and many cross-breeds and mixed wools. The chief breeds are the Southdown, Hampshire, Dorset Down, Devon Long and Close, Cheviot, Exmoor, Kent, Ryeland, Shropshire, Oxford, Welsh Black, Welsh Mountain, Masham, Clun Forest, Border Leicester, Kerry and Radnor. It has been operating since 1924, when it started with 65,000 fleeces. Its total in 1928 was 150,000 fleeces, value £55,764. Its expenses of management were 1½d. a lb. As in the case of Kent, it makes an immediate substantial advance to farmers on receipt of wool, grades it and sends 25 per cent. samples to London with a minimum of five bales. It issues advice to wool growers as to conditions that should be maintained both in sheep

and shed at shearing-time, methods of rolling and packing, instructing them to put tailings, trimmings, belly wool, and other loose wool in separate bags specially provided.

This Society, although doing good business in improving the presentation and sale of the wool of its clients, probably suffers in prestige because of the absence of definite contracts and support by a majority of local sheep-breeders. It is never certain how much first-class wool it will handle each year, and farmers, without contracts and perhaps without a true understanding of the potential value of the Society, are tempted to keep their better classes for separate sale, playing for safety by sending the indifferent wools to the Society. Over such an area the Society's turnover should be many times as great, or indeed there might be several societies if farmers consulted their own interests sufficiently.

(24) *The Eastern Wool Growers, Ltd.*, is much smaller than the two previously described, dealing at present only with about 40,000 to 50,000 fleeces annually. It has been in existence for three years and functions in the same way as the others, collecting, grading and selling by auction on the London market. Its usual costs for the services it renders are 1½d. a lb. It has a definite system of three-year contracts with its members, and will, no doubt, expand as soon as the sheep breeders in the Eastern counties realize the steady advantages which co-operative sale will give them and the importance of whole-heartedly supporting the undertaking.

(25) *The Midland Wool Growers, Ltd.*, has recently completed its first year's working. It has dealt with 48,000 fleeces which it has sold for upwards of £21,000 net. Its cost for grading, carriage, brokerage, insurance, labour and management work out at 1½d. a lb. The Society claims that it gives more service to its members than other societies, and that, on their bases, its comparable cost would be 1½d. per lb. This Society again deals with a very large number of grades of wool, and is also handicapped by the lack of definite contracts.

(26) *The Scottish Wool Growers, Ltd.*—This Co-operative Society was formed two years ago with the assistance of the Scottish Agricultural Organization Society and Scottish National Farmers' Union. It adopted the course of appointing as manager and secretary an expert wool buyer who not only had experience of the trade but knew something of the producer's end of the business. The Society set out to deal with at least 7½ per cent. of the Scottish wool clip on the assumption that if it could not obtain so large a proportion, it might not be able to carry on as an economic unit. The advantages the Society offers to farmers are that the organization is run so as to handle wool at the least possible expense and to obtain the highest prices from the actual user of the wool. It gets in touch with buyers in the principal consuming countries and thus performs for the members of the Society the function of wool brokers. The Society is ready to take any wools belonging to members or non-members, and those members who enter into an agreement with it for the disposal of the whole or part of their wool for a period of three years are given an extra share in the profits. For membership, growers have to take up from five shares to 200 shares of £1 each, and small-holders are allowed to become members by taking up one share of £1. A payment of 5 per cent. interest on the share capital is paid as a first charge on the net earnings, and the remainder applied either to reserve or as a bonus to the members. Sheep breeders in the North of England are entitled to become members.

The Society sells the wool on behalf of its clients and deducts a charge for the expenses and services of the Society. Its interest earned

on share capital has increased from 8 per cent. in the first year to 18½ per cent. in the second year. The increase arises out of economies which the Society has been able to make between its fixed charges for services and the actual expenses. It is clear that as the amount of wool dealt with increases, the expenses per lb. or per ton of wool are reduced.

The reason that the Society in the first instance required a guarantee of supplies for at least three years was to avoid the serious risk which it ran as a new and independent competitive unit in the market. That risk has now disappeared with the assured success of the Society, but the contract system remains part and parcel of its organization to the undoubted advantage of contracting farmers.

The Society issues instructions and advice to its clients as to means that should be adopted in preparing wool for market, and its influence has improved supplies and made them more acceptable to buyers. The Society considers that it is able to get better prices for the clip than those obtained in the ordinary way because the wool is well prepared and graded and sold, in most cases direct to the user. As an instance of the business enterprise shown by the Society, it may be mentioned that, in the first year, numbered samples of wool of varieties which were more or less constant and could be repeated were sent to foreign buyers. This enabled a buyer after an order which had given satisfaction to repeat his order simply by quoting the number of the sample. It was found to be a distinct advantage in the case of foreign Sales. In the second year, the Society increased its membership by 40 per cent. and its wool turnover by 46 per cent.

(27) It will be seen from this brief account that the Wool Societies which have in the comparatively short period of their existence had most success are those which have had the best business advice to start with. Immediate success to a Society seems to us to be likely to be more certain where there are fewer grades of wool to deal with and where contracts with growers are insisted on. That societies not having these advantages have made substantial progress is testimony to the inherent soundness of the idea of co-operative sale as well as to the unremitting efforts of their leaders.

(28) It is true, however, to say that at present in an area already covered by an existing wool society the percentage of sheep farmers who send their wool to the society is not nearly large enough. If it were larger—say 75 or 80 per cent.—it would be possible to simplify grading and classing by dealing with the wools of a district which produced similar types together as in the case of Kent. For this purpose the country should be divided into sections or regions each under a wool society large enough to deal economically with the wool produced in it. The right type of man should be engaged to manage the business and it should be the society's aim to improve, collect, grade and sell the wool of its members. The confidence of the market should be sought and obtained through high quality of produce delivered, and a system of marking by quality, as adopted for other agricultural produce in the National Mark Scheme, should not be too difficult to work out and operate. When such an aim had been realized, it should be possible to sell wool on the London market, or direct to large buyers at home and abroad as is done by the Scottish Wool Society, on sample of a trifling percentage of the grade and so avoid the transport costs of a 25 per cent. sample travelling to London. The societies should be financially strong enough to hold their wool, where necessary, for the return of the market should prices sag, and, in any case, could arrange with each other for the orderly marketing of most of the home clip.

(29) The following heads cover our chief recommendations :—

Production of Wool

- (1) Improvement of wool through better breeding by the use of rams of good wool as well as good meat characteristics. Pure bred wool is the best, and next the wool of first crosses. Mixed wools (and mixed sheep) should not be produced.
- (2) Efforts should be made to reduce the number of breeds and crosses and thereby the number of grades and classes of wool to the real requirements of the wool manufacturing industry. This reduction should, however, be dependent on the requirements of the farmer for his major purpose of growing mutton and lamb.
- (3) To effect (2), the British Wool Research Association at Leeds might be asked to make careful inquiry and report what steps are practicable.

Preparation of Wool

- (1) All farmers should be advised to keep their fleeces free from admixture with vegetable matter, twine, dirt, etc.
- (2) They should ascertain whether the market really prefers their particular wools washed, and whether it pays them to wash.
- (3) Fleeces should be properly prepared, and the daggings and pieces packed separately.
- (4) Tar or pitch markings should not be used, the marking substances recommended by the British Wool Research Association at Leeds being generally advised.

Co-operative Action

- (1) Farmers should group together to secure the advantages of grading fleeces and of the co-operative sale of wool. Several thousand fleeces are required to start with, and a society is unlikely to be able to pay its way on less than 50,000 fleeces per annum. After a few years, the number should be at least 150,000 to 200,000.
- (2) The tendency at present is for new societies to cover areas which are too large for the business dealt with. It cannot be so profitable to send wool to a distant centre to be graded and then a 25 per cent. sample to London for sale as to send it to a near one which deals with fewer grades of wool. The country should be divided into regions which are economic units for this purpose.
- (3) A system of firm contracts between members and the society for a period of years should be an essential part of a national plan of improved wool selling.

General

- (1) The prospects for wool production in this country appear to be fairly good. Wool which sold in 1914 for 15d. per lb. was sold in 1928 for over 24d. The production of wool in the whole country, including Ireland, is estimated at about 110 million lb., about one-half of which is exported. Annual consumption of wool in this country is about six times the production. Sheep-farmers may, therefore, set about improving their wools with confidence.
- (2) Questions of the scientific nature and composition of wools are at present being investigated by the British Wool Research Association at Leeds, which is supported mainly by contributions from the trade. The primarily producers' questions of improved production and preparation are also being dealt with by that body. It seems to us that producers should share in the cost of these investigations, or at any

rate should see that the Association does not stand in need of any increased facilities for the work it is carrying out in their interests.

- (3) We are glad to learn that the National Farmers' Union is giving increased attention to the question of the formation of co-operative wool societies, and we trust that this report may incidentally be of some assistance to them in their labours.
- (4) The Ministry of Agriculture, as part of its improved marketing policy, might usefully give more attention to wool in order to investigate, in conjunction with the National Farmers' Union, whether it is possible to grade well-known qualities of wool under the National Mark Scheme and sell them to better advantage than at present. British wool or some of it, like other commodities grown in this country, no doubt has special qualities of its own owing to soil and climate. These might usefully be ascertained and advertised so that farmers can be sure that their wool is taking its rightful place on the world's markets. Our inquiries tend to show that it is not doing so at present, and we consider that the whole subject deserves thorough investigation.

May 4, 1929.

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JUNE ON THE FARM

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Root Cultivation.—Mangolds, potatoes, early-sown kale, beet, and in some districts swedes, find employment for men and horses in hoeing during the greater part of June. Without crops of this class, until the hay is ready to cut, there is little field work of pressing importance, except perhaps thistle cutting, docking and the ploughing of bare fallows. Roots drilled on the ridge permit of horse hoeing, even without the aid of a driver, at an earlier date than is possible with crops sown on the flat, as in the latter case it is necessary to wait for the appearance of a well-defined row. On clean land and in a good germinating season, this is soon obtainable; but when, as in 1928, the crop seed lies dormant for a long time, while weeds come up, the crop drilled on the flat is under a disadvantage. On the ridge also, close hoeing is not so liable to cover the crop seedlings with soil; but hoe blades are now available which materially reduce this liability even in flat cultivation. There is much to be said, however, in favour of the wheeled hand hoe for the first close work among root seedlings; and, contrary to what I find is a common impression, the use of this appliance is not a test of physical endurance.

The striking-out of mangolds and beet, leaving the plants in bunches, should precede the work of singling; the latter should, preferably, be done by hand. Recently a labour and pain-saving device for root singling has been introduced on the Continent

which would at first probably excite ridicule in this country. The labourer rests his body on a broad belt supported by a two-wheeled trolley, which he pushes along as he crawls forward, both hands being free for weeding and singling.

The transplanting of marrow-stem kale for filling up gaps in other root crops may follow the work of singling. For planting seedlings of any kind, no tool is better than the ordinary builder's trowel. One farmer to whom I introduced this device a year or two ago, assures me that even mangolds readily take root when transplanted with a trowel. Kale, however, transplants very successfully.

June is the ordinary month for sowing swedes in the southern half of Britain, although farther north May is the usual month and, except for the risk of bolting, April is not too early. The reason for deferring the sowing till June in the Midlands and Southern counties is to avoid attack by "mildew." This disease is a serious one, for the affected crops may become almost leafless when half bulbed ; and growth is resumed only after a delay which involves serious loss of yield and is associated with bad keeping properties in the roots. In hot dry years, such as 1921, mildew appears in districts where normally it is never seen. Mildew—a term used for both the fungus and the aphid pests which turn the foliage white—is associated with droughty conditions. Early sowing gives a crop that dries the soil considerably ; and if the crop is big and leafy—and therefore needing much moisture—at the time when hot droughty conditions occur, the pest finds a receptive host. On dry soils in dry districts, it is better to conserve soil moisture by fallowing operations—avoiding unnecessary deep ploughing—until June. Beet and mangolds, especially the first, are of deeper rooting habit than swedes, hence they may be sown earlier. Common turnips, although more leafy than swedes, are less liable to drought and mildew, because of their deeper rooting habit.

Insect pests often do great damage to root crops in June. The turnip flea beetle is best checked by soaking the seed in paraffin just before drilling ; but if this has been omitted, the crop can be helped by careful top-dressing with nitrates, by rolling, and by the use of a beetle catcher—a tarred or white-painted board pushed over the crop. Practical testimony of the value of this method of checking the beetle has reached me from several sources. The mangold or beet leaf fly is best dealt with by rolling while the plant is small—as soon as the first brood of eggs has been laid. As a preventive measure, on the results of recent

investigations by the German Biological Institute, the beet fly may be combated by spraying the leaf with a sweetened poisonous solution or sowing chaff treated with the same fluid : the object is to attract and poison the fly that lays the eggs. Early sown crops usually suffer most from the beet fly.

Haymaking.—It is well-known that average hay is not nearly such effective cattle food as is ordinary pasture grass, the latter being equivalent to hay plus concentrates. There is however, a wide range of variation in the quality of hay, that of 1927 being generally unproductive while the hay of the 1928 harvest was outstandingly good. Possibly some of the difference in the produce of the two years was due to some unrecorded contrast in the nutritive quality of the grass before drying, but there is no doubt that the excellence of last year's fodder was largely due to the rapid harvesting which favourable weather conditions made possible.

The effectiveness of the 1928 crop has emphasized the importance of quality rather than bulk of fodder. On many farms—where straw is abundant—there is normally a liberal supply of fibrous matter which can if necessary be used to supplement the hay allowance. Here especially it would seem advantageous to secure an early cut of digestible protein-rich hay at the expense of a lighter total yield. At present, however, it is not practicable to carry this idea beyond the point of mowing earlier than usual after the grasses have thrown up their flower-stalks ; and where it is customary to mow “ seeds ” crops twice in the year, as is often the case with Italian ryegrass and broad red clover mixtures, the loss of weight in the first crop may be largely recovered in the heavier second crop.

Of even more importance than early cutting is the avoidance of exposure of the cut grass to unfavourable drying weather. It is obviously futile to mow grass for drying by ordinary methods if there is likelihood of a spell of wet weather prevailing during the following week. On the other hand it would be unwise to allow a favourable forecast to pass because of a little immaturity in the crop. Moreover, either the first fields must be cut rather too early or the last fields rather too late, and an early start is a good rule. Late mowing is not good for the land, as it encourages weeds, and on some soils leads to the formation of a tough unpalatable sward.

In wet years haymaking is expensive and often results in fodder of low nutritive value. Were it only possible for the farmer to know whether there will or will not be two or three

weeks of sunshine, he would be able to decide whether to wait for it or to adopt one or other of the several methods customary in humid districts. Much hay is spoilt that could have been saved—with less labour expenditure—by the adoption of the practice of cocking.

During 1927 many farmers made silage stacks for the first time, and on the results of that experience the majority of them would have less hesitation in resorting to ensilage in future. Much is said about the waste that occurs around the outside of the stack, but this loss may be considerably smaller than the invisible wastage of nutritive value which goes on when the half dead grass is weathered in the swath or windrow: the loss in this case may be fifty per cent. For making good stack silage the grass should be put together while still living, but not wet or too sappy; there is no need—but rather a disadvantage—in making a “stack bottom” on which to build the silage.

The principle of tramp rick haymaking is the fact that “gay” hay cannot become dangerously hot in a mass of less than $1\frac{1}{2}$ tons; and it will not become mouldy or sour if it heats sufficiently by the fermentation of natural sap. The grass is half dried before being ricked and is trampled very firmly during the building. This practice is in many respects similar to that of making sweet silage, but the hay is restacked in larger ricks or barns after about six or eight weeks, by which time it has become cool and dry.

Leaders of German agricultural practice strongly advocate the use of pyramidal drying frames for the curing of clover and lucerne hay. It is claimed that this method not only avoids the loss of leaf and fine parts, which occurs when leguminous hay is turned and dried on the ground, but also produces a more palatable as well as a more nutritious hay. The method is of special interest, however, as being specially adapted for humid districts. The frames consist of three 9-ft scantlings joined at the top to form a pyramid, with three horizontal pieces each about 8-ft long placed about 2-ft from the ground. About four to six such “Reiters” are needed per acre, hence the cost in timber is not prohibitive. The crop is allowed to dry in swath for a day or two before being put up, turning being necessary only in bad seasons. This method is an extension of that followed in the north-east of Scotland, where large cocks are built with a wooden boss up the centre—but in this case the “rick” is on the ground, which is objectionable.

The large German pyramid is unsuitable for drying finer herbage such as meadow grass, which packs tighter and moulds

more readily than does clover. In this case smaller frames may be used, each carrying about $\frac{1}{2}$ to 1 cwt. of hay when dry. Farmers who have used sheep hurdles, a pair leaning together, will confirm the advantage of the adoption of this practice when weather conditions prevent ordinary drying methods.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended May 8.				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15 $\frac{1}{2}$ %) ..	10 13d	10 13d	10 13d	10 13d	12 9
Nitro-chalk (N. 15 $\frac{1}{2}$ %) ..	10 0f	10 0f	10 0f	10 0f	12 11
Sulphate of ammonia:—					
Neutral (N. 20·6%)..	10 13d	10 13d	10 13d	10 13d	10 3
Calcium cyanamide (N. 20·6%)	9 16e	9 16e	9 16e	9 16e	9 6
Compound white nitrates lime and ammonia B.A.S. (N. 15 $\frac{1}{2}$%) .. ..	..	10 10h	..	..	..
Kainit (Pot. 14%)	3 6	2 19	2 19	3 2	4 6
Potash salts (Pot. 30%) ..	5 3	..	4 17	5 1	3 5
„ (Pot. 20%)	3 15	3 9	3 8	3 12	3 7
Muriate of potash (Pot. 50%)..	9 17	9 3	9 2	9 0	3 7
Sulphate,, „ (Pot. 48%)..	11 9	11 6	11 5	11 5	4 8
Basic Slag (P.A. 15 $\frac{1}{2}$%)|| ..	2 8c	2 2c	..	2 9c	3 1
„ (P.A. 14%)|| ..	2 3c	1 16c	1 16c	2 4c	3 2
„ (P.A. 11%)|| ..	..	1 9c	1 9c	..	..
Ground rock phosphate(P.A.2- 27 $\frac{1}{2}$ %)	2 10||	2 7||	..	2 5a	1 8
Superphosphate(S.P.A.16%)..	3 7	..	3 6	3 6	4 2
„ (S.P.A.13 $\frac{1}{2}$ %) ..	3 2	2 15	3 0	3 0	4 4
Bone meal(N.3 $\frac{1}{2}$ %,P.A.20 $\frac{1}{2}$ %) ..	8 15	8 10	8 12	8 0	..
Steamed bone flour (N. $\frac{1}{2}$ %, P.A. 27 $\frac{1}{2}$ -29 $\frac{1}{2}$ %)	5 17b	..	6 10	5 10	..

Abbreviations : N.=Nitrogen ; P.A.=Phosphoric Acid ; S.P.A.=Soluble Phosphoric Acid ; Pot.=Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 80% through standard sieve. a. 85% through standard sieve.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots ; at Bristol, f.o.r. Bridgwater ; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra. Rebate of 1s. per ton will be allowed.

e Delivered in 4-ton lots at purchaser's nearest railway station. Rebate of 1s. 3d. per ton will be allowed.

f Prices for 2-ton lots. Rebate of 1s. per ton will be allowed.

h F.o.r. Goole.

Live Stock.—In spite of the virtues of good pasture grass as a food for dairy cows, spring calvers which are in full flow of milk in June do not make such good records in the year as autumn calvers. It is possible that the cow in full milk on June grass may derive benefit later from supplementary feeding. Some farmers feed concentrates to heavy yielders even on good grass in June, and they do so because they believe that it enables the cow to continue longer on a high note. As far as I am aware, this point has not been tested experimentally; but from both theory and practice we do know that foods of the maize and barley class make a good supplement to good pasture.

The same principle—feeding carbohydrates rather than albuminoids—may well be tried with other classes of stock on June grass. Lambs and calves may well receive a less albuminous mixture of concentrates than was formerly recommended before the true character of short pasture herbage was appreciated.

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NOTES ON FEEDING STUFFS

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The Protein in the Ration.—Protein, the flesh-forming constituent of feeding stuffs, is of primary importance from the standpoint of nutrition, since it is an indispensable component of the diets of all animals. The activities which go on without cessation in the minute cells of the animal body, and which give rise to the phenomenon of living, involve the continual destruction, or partial destruction, of the protein in the cells. This much has been made clear by studying the changes which go on in the body of an animal during prolonged periods of fasting. Under such conditions, the animal is compelled to draw on its body reserves in order to provide itself with the energy to keep the heart beat and blood circulation going normally, and to maintain body temperature. During the earliest stages of fasting, the glycogen reserves of the liver and muscles are used for this purpose. This is quickly followed, however, by calls on the main fuel reserve of the animal, namely, body fat, 1 lb. of which can furnish the organism with about two and a-third times as much energy as is derived from the oxidation of 1 lb. of a carbohydrate like glycogen. During all this time, body protein is continuously being used up also, as is evidenced by the

appearance in the urine of nitrogenous substances, which are the final degradation products of such protein breakdown. The amount of these nitrogenous substances in the urine under such conditions is a measure of the wastage of body protein which normally goes on in the body as a consequence of cell activity. So long, however, as the fasting animal possesses appreciable fat reserves, the amount of protein degradation is small. This constituent must be conserved, since it forms the structural material of the organism. When the fat reserves have been almost exhausted, then, and only then, does the animal begin to draw appreciably on its tissue protein for heat and energy purposes, a stage which is marked by an abrupt rise in the amount of nitrogenous material appearing in the urine. This so-termed "premortal rise" foreshadows the speedy death of the animal if the fast is further continued.

It is clear, therefore, that the "wear and tear" of living entails a continual wastage of body protein in the animal. For this reason, an animal must receive, at the very least, an amount of protein in its daily food sufficient to make good such losses. The first call on food protein is for the purpose of repairing worn-out body tissue. Although, in the case of human beings, the magnitude of this minimum protein requirement has never been satisfactorily defined, it is known with a good degree of certainty for farm animals. The scientific feeding standards are based on the principle of supplying, in the first place, an allowance of food containing sufficient digestible protein and starch equivalent for maintenance purposes, and then adding to this a further allowance in conformation with the production requirements of the animal. The maintenance requirements of a 1,000-lb. bullock, for instance, are met by a ration containing 6 lb. of starch equivalent, including 0.7 lb. of digestible protein. On such a ration a bullock of this live-weight will be maintained in a healthy condition without gaining or losing flesh. The starch equivalent in the ration will be just sufficient to supply all the energy requisite for the living processes, and on such a diet the animal will neither be receiving a surplus of starch equivalent for fat formation in the body, nor will it be under the necessity of having to draw on any of its body reserves for energy purposes. In the same way, the amount of digestible protein in the ration is just adequate to make good the "wear and tear" wastage of body protein, none being left over for productive purposes.

It is not easy to form a correct conception of the function of protein in the feeding of animals without first gaining an insight into the chemical nature of this food constituent. Like all other substances, protein is made up of almost infinitely small particles known as molecules. Compared with the molecule of a substance like common salt, however, that of protein is big and complex. If it were possible, by sufficiently high magnification, to view the internal structure of a protein molecule, it would be found that protein is formed by the union of a very large number of molecules of substances of much simpler construction. These simpler substances are known as amino acids, and they may be regarded as the "building stones" from which the complex protein is built up. About 20 different amino acids have been isolated from proteins. They all contain the elements carbon, hydrogen, oxygen and nitrogen, and one at least also contains sulphur.

Nature, in plant and animal, is able to build up from these amino acids a very large number of different kinds of protein. In the casein of milk, for example, the amino acids are joined together in very different proportions from those in which they are found in the albumen of milk or the protein of flesh. It is remarkable, however, that the mammary gland, when building up casein, always selects from the blood stream the correct proportions of the different amino acids and, what is perhaps still more remarkable, always links them up in exactly the same order. In other words, casein from the milk of cows never varies in its chemical make-up. For many years it was also thought that the casein of cow's milk was identical with the casein of ewe's milk, since the ordinary methods of chemical analysis failed to distinguish between them. By employing more refined methods, however, the writer was able to demonstrate that, despite their identity in respect of amino acid content, sheep's casein and cow's casein are two entirely distinct substances, the difference arising from the circumstance that the amino acids are linked up *in different orders* in the two types of casein. In an extension of this work, the writer further succeeded in showing that the albumins of milk and of blood are also distinct substances. It follows, therefore, that the presence of albumin in milk is not due to a "filtration" of this protein from the blood stream into the mammary secretion, but is the consequence of a separate mammary synthesis, the amino acids of the blood furnishing in all probability the materials for this synthesis.

The digestion of the protein of feeding stuffs in the animal results in its breakdown to the amino acids from which it was originally built up. Unlike protein, the amino acids are crystalline soluble substances capable of ready absorption from the intestinal tract into the blood stream. It is in the form of amino acids, therefore, that food protein ultimately passes into the organism. This simplification of protein into its constituent amino acids is brought about by the successive actions of three digestive ferments, or enzymes, viz., pepsin in the stomach, trypsin in the duodenum and erepsin in the small intestine. The digestion is of a progressive nature, the pepsin breaking down the complex protein to somewhat less complex substances known as proteoses and peptones, the trypsin carrying the process of simplification further to the stage of polypeptides and the erepsin completing the breakdown to the simple amino acids. Such ferments or enzymes are not to be confused with living organisms like bacteria, the latter only displaying their characteristic activities by virtue of the enzymes they are able to elaborate. Enzymes are organic substances, frequently not very dissimilar from proteins, which, by mere contact with certain complex types of compounds under suitable conditions of temperature, can cause the complex compounds to be transformed into simpler substances. Most of the characteristic changes which occur during the digestion of food are brought about by the action of enzymes secreted into the alimentary tract. The nature of the enzymic digestion of protein will be appreciated when it is stated that in order to imitate such change in the laboratory, it is necessary to boil protein with fairly concentrated hydrochloric acid for about two days.

How do the amino acids function after their absorption into the blood stream? There is first a call on them for the repair of "worn-out" body tissue. This is referred to as the maintenance protein requirement of the animal, and represents the sole requirement of protein in the mature, non-producing animal.

In the young growing animal, there is a further call on the amino acids for the building up of new tissue protein (live-weight increase). The dairy cow also requires an extra supply of amino acids for synthesizing the proteins of the milk secretion. The requirements, in respect of amino acids, of the dairy cow are met when the ration contains 0.7 lb. of digestible protein for maintenance and, in addition, 0.6 lb. of digestible protein for every gallon of milk. In the case of

the fattening animal, it is necessary to feed only a small amount of digestible protein in excess of the maintenance requirements of the animal.

It will next be of interest to inquire what happens to the excess of amino acids when protein is fed to an animal beyond its requirements for maintenance and production. Such surplus is subjected to a change, technically known as de-amination, which is mainly brought about during the passage of the blood stream through the liver. As a result of this change, the amino acids are deprived of their nitrogen, which is removed in the form of ammonia. The latter is rendered innocuous to the organism by combination with carbon dioxide in the blood stream and is finally transformed into urea, which is excreted as a waste product through the kidneys into the urine. It is clear, therefore, that the nitrogen contained in protein fed in excess of the actual protein requirement of the animal is not retained in the body, but is lost in the urine in the form of urea.

By the removal of nitrogen from the amino acids, however, the latter are transformed into organic acids of the nature of lactic acid, the acid which is also found in sour milk. Should the carbohydrate in the ration be insufficient to supply the animal with ample energy, these organic acids may undergo oxidation in the body to provide the necessary warmth and energy. If there is no need in this direction, however, such organic acids are able to undergo complex transformation with the formation of fat in the body. An excess of digestible protein in the ration, therefore, functions in much the same way as does carbohydrate and can, according to circumstances, constitute a source of energy or of body fat. This fattening value of protein should be kept in mind. Kellner showed, in the respiration studies which gave rise to his system of starch values, that when protein is added to the maintenance ration of a fattening bullock, then 1 lb. of digestible protein has the same fattening value as 0.94 lb. of starch.

It is, however, considered unsound practice to feed excessive amounts of protein to farm animals. The balanced ration is one which conforms, in respect of protein, to the actual requirements of the animal for this constituent. From what has been written, it will be inferred that the inclusion of excessive allowances of protein in the diet of an animal must throw a heavy burden on the kidneys, whose function it is to eliminate the large amounts of urea which arise in the body from such feeding. Indeed, certain writers have attributed

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	—	—	10 2	0 13	9 9	72	2 7	1-38	9-6
Barley, British feeding ..	—	—	9 15	0 10	9 5	71	2 7	1-38	6-2
" Canadian No. 4 Western ..	34 9	400	9 15	0 10	9 5	71	2 7	1-38	6-2
" " feed	32 0	"	9 0	0 10	8 10	71	2 5	1-29	6-2
" American	31 6	"	8 17	0 10	8 7	71	2 4	1-25	6-2
" Persian	32 0	"	9 0*	0 10	8 10	71	2 5	1-29	6-2
Oats, English, white	—	—	10 7	0 11	9 16	60	3 3	1-74	7-6
" " black and grey ..	—	—	10 0	0 11	9 9	60	3 2	1-70	7-6
" Scotch, white	—	—	10 10	0 11	9 19	60	3 4	1-78	7-6
" Argentine	26 6	320	9 5	0 11	8 14	60	2 11	1-56	7-6
" Chilian	25 3	"	8 17½	0 11	8 6	60	2 9	1-47	7-6
" German	29 3	"	10 5	0 11	9 14	60	3 3	1-74	7-6
Maize, American	40 0	480	9 7½	0 10	8 17	81	2 2	1-16	6-8
" Argentine	41 6	"	9 13	0 10	9 3	81	2 3	1-20	6-8
Beans, English, winter ..	—	—	10 17†	1 5	9 12	66	2 11	1-56	20
Peas, Japanese	—	—	20 5½	1 2	19 3	69	5 7	2-99	18
Dari	—	—	10 10*	0 12	9 18	74	2 8	1-43	7-2
Millers' offals—									
Bran, British	—	—	7 6	1 3	6 3	42	2 11	1-56	10
" broad	—	—	8 12	1 3	7 9	42	3 7	1-92	10
Middlings, fine, imported ..	—	—	8 17	0 18	7 19	69	2 4	1-25	12
" coarse, British	—	—	7 5	0 18	6 7	58	2 2	1-16	11
Pollards, imported	—	—	7 9	1 3	6 6	60	2 1	1-12	11
Meal, barley	—	—	10 5	0 10	9 15	71	2 9	1-47	6-2
" maize	—	—	10 15	0 10	10 5	81	2 6	1-34	6-8
" " germ	—	—	9 15	0 16	8 19	81	2 3	1-20	10
" locust bean	—	—	9 10	0 8	9 2	71	2 7	1-38	3-6
" bean	—	—	12 15	1 5	11 10	66	3 6	1-87	20
" fish	—	—	19 10	3 9	16 1	53	6 1	3-26	48
Maize, cooked flaked	—	—	11 15	0 10	11 5	85	2 8	1-43	8-6
" gluten feed	—	—	10 7	1 0	9 7	76	2 6	1-34	19
Linseed cake, English, 12% oil ..	—	—	13 15	1 10	12 5	74	3 4	1-78	25
" " " 9% "	—	—	13 5	1 10	11 15	74	3 2	1-70	25
" " " 8% "	—	—	12 15	1 10	11 5	74	3 0	1-61	25
Soya bean " " 54% "	—	—	11 10†	2 2	9 8	69	2 9	1-47	36
Cottonseed cake, English—									
Egyptian, 44% "	—	—	7 15	1 9	6 6	42	3 0	1-61	17
" " Egyptian, 44% " ..	—	—	7 7	1 9	5 18	42	2 10	1-52	17
Coconut cake, 6% oil	—	—	10 12	1 5	9 7	79	2 4	1-25	16
Ground-nut cake, 6-7% oil ..	—	—	9 5	1 8	7 17	57	2 9	1-47	27
Decorticated ground-nut cake, 6-7% oil	—	—	11 17†	2 3	9 14	73	2 8	1-43	41
Palm kernel cake, 44-54% " ..	—	—	9 15†	0 18	8 17	75	2 4	1-25	17
" " " meal, 44% " ..	—	—	10 5†	0 18	9 7	75	2 6	1-34	17
" " " meal 1-2% " ..	—	—	9 7	0 19	8 8	71	2 4	1-25	17
Feeding treacle	—	—	6 0	0 9	5 11	51	2 2	1-16	2-7
Brewers' grains, dried ale ..	—	—	8 17	1 0	7 17	49	3 2	1-70	13
" " " " porter	—	—	8 7	1 0	7 7	49	3 0	1-61	13
Malt culms " "	—	—	7 15*	1 8	6 7	43	2 11	1-56	16

* At Bristol.

† At Hull.

‡ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of April and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22-4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1-43d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 8s. 4d.; P₂O₅, 8s. 10d.; K₂O, 8s. 5d.

the condition of "pulpy kidneys" in sheep to this cause, though it must be confessed that the experimental evidence on this matter is not entirely convincing. The writer will have more to say on this subject in the Notes for next month, when the question of the balancing of the rations for farm animals will be considered.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	9 3
Maize	81	6.8	9 10
Decorticated ground nut cake	73	41.0	11 17
" cotton cake	71	34.0	11 10

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2.43 shillings, and per unit protein equivalent, 1.83 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1928, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	9 13
Oats	60	7.6	8 0
Barley	71	6.2	9 4
Potatoes	18	0.6	2 5
Swedes	7	0.7	0 18
Mangolds	7	0.4	0 18
Beans	66	20.0	9 17
Good meadow hay	37	4.6	4 18
Good oat straw	20	0.9	2 10
Good clover hay	38	7.0	5 5
Vetch and Oat silage	13	1.6	1 14
Barley straw	23	0.7	2 17
Wheat straw	13	0.1	1 12
Bean straw	23	1.7	2 19

* * * * *

EXPORT OF BREEDING STOCK

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland in the three months ended March, 1929, compared with the corresponding period in 1928. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	January to March, 1929		January to March, 1928	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	17	2,040	68	7,200
Chile	7	1,027	0	0
China	0	0	10	275
Colombia	0	0	6	640
Uruguay	2	300	0	0
Canada	0	0	35	1,500
Falkland Islands ..	0	0	4	259
Irish Free State ..	429	12,609	827	17,541
Kenya	26	1,417	16	496
Southern Rhodesia ..	48	3,240	0	0
Union of South Africa ..	17	1,292	0	0
Other countries ..	8	896	14	734
Total	554	22,821	980	28,645
SHEEP AND LAMBS				
Argentina	201	4,870	160	3,690
Brazil	3	150	10	250
Chile	8	289	21	894
Colombia	7	140	3	57
Peru	16	200	0	0
United States of America	2	50	58	800
Uruguay	19	330	17	390
Canada	0	0	12	350
Irish Free State ..	6	50	21	104
Other countries ..	4	99	9	45
Total	266	6,178	311	6,580
SWINE				
Denmark	4	145	0	0
France	2	33	31	566
Germany	21	187	3	120
Hungary	26	105	27	810
Italy	4	28	2	120
Peru	6	114	0	0
Irish Free State ..	37	251	71	212
Kenya	14	251	4	100
Tanganyika Territory ..	0	0	6	60
Other countries ..	7	165	13	289
Total	121	1,279	157	2,277

APPOINTMENTS: CHANGES AND CORRECTIONS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Yorkshire (Department of Agriculture, University of Leeds): Mr. T. L. Bywater, B.Sc., has been appointed Assistant Lecturer in Agriculture.

DEVELOPMENT COMMISSION

Sir Thomas Middleton, K.C.I.E., K.B.E., C.B., has been appointed Vice-Chairman of the Development Commission in succession to Mr. Vaughan Nash, C.B., C.V.O., who will retire at the end of this month (June). Mr. Nash will continue to serve as a Development Commissioner (unpaid).

Sir Walter W. Berry, K.B.E., whose term of office as a member of the Commission expired on May 11, has been re-appointed.

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THE AGRICULTURAL INDEX NUMBER

THE general index number of agricultural produce in April was 3 points higher than in March at an average of 46 per cent. above the level of 1911-13, which compares with a rise of 6 points to 51 per cent. during the corresponding period a year ago. The commodities chiefly responsible for the rise last month were milk, hay and fat pigs, but the increases were partially offset by a decline in the index numbers for fat cattle, eggs and potatoes.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1924 :—

		Percentage increase compared with the average of the corresponding month in 1911-13					
Month		1924	1925	1926	1927	1928	1929
January	..	60	71	58	49	45	45
February	..	61	69	53	45	43	44
March ..	..	57	66	49	43	45	43
April ..	..	53	59	52	43	51	46
May ..	..	57	57	50	42	54	—
June ..	..	56	53	48	41	53	—
July ..	..	53	49	48	42	45	—
August..	..	57	54	49	42	44	—
September	..	61	55	55	43	44	—
October	..	66	53	48	40	39	—
November	..	66	54	48	37	41	—
December	..	65	54	46	38	40	—

Grain.—Quotations for wheat rose on the month by 2d. per cwt., but, as this increase was proportionately the same as in the base years, the index figure was unchanged at 30 per cent. above 1911-13. In the case of barley, however, the

index number was 4 points higher, although values were reduced by 1d. per cwt., the fall in the base years being relatively heavier. Oats were unaltered either in price or index number.

Live Stock.—Fat cattle became slightly dearer in April, but as the increase was proportionately less than in the corresponding month of the base years, the index figure showed a fall of 2 points. Values for fat sheep were on average 53 per cent in excess of pre-war as against 52 per cent. during the previous month. Bacon and pork pigs became still dearer, and the relative index figures advanced by 15 and 8 points to 73 and 74 per cent. above 1911-13. Quotations for dairy cows fell by about 5s. per head and the index figure by 1 point to 29 per cent. over the level of April, 1911-13. Store cattle and sheep realized about 2s. per head more, but in each instance the index number was lower, cattle averaging 18 per cent. and sheep 54 per cent. above the base price. Store pigs continued to rise in price, and the index figure during the month under review appreciated by 14 points to 71 per cent. above pre-war, as compared with 35 per cent. in April, 1928.

Dairy and Poultry Produce.—As a result of the revision in the prices for April and August recently agreed by the Permanent Joint Milk Committee the average contract price of milk during April was considerably lower than in March, but as the fall in the base years was proportionately greater, the index figure was 17 points higher at 77 per cent. in excess of pre-war. Butter became cheaper at 51 per cent. above the 1911-13 prices, but cheese advanced by 1s. 6d. per cwt., and the index number showed a rise of 2 points to 76 per cent. over pre-war. Eggs, which in March had maintained an unusually high level on account of the severe weather restricting supplies, experienced a sharp decline, values falling by over 6d. per dozen, and the index number declined 48 points to 45 per cent. above the base period. A year ago eggs were 37 per cent. dearer than in 1911-13. Poultry averaged 38 per cent. over the base years as against 40 per cent. during the preceding month.

Other Commodities.—Potatoes in April were about 5s. per ton cheaper than in March and the index figure fell by 25 points, while the index for vegetables was 60 points lower on the month at about 100 per cent. above pre-war. The backward state of the pastures caused stocks of hay to be drawn upon to a greater extent than usual, and prices rose

by from 2s. 6d. to 5s. per ton and the index number by about 3 points. Wool showed no material change.

Index numbers of different commodities during recent months and in April, 1927 and 1928, are shown below :—

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1927	1928	1929			
	April	April	Jan.	Feb.	March	April
Wheat	52	34	30	31	30	30
Barley	41	41	26	28	28	32
Oats	18	64	34	36	36	36
Fat cattle	25	43	35	34	33	31
Fat sheep	53	78	67	56	52	53
Bacon pigs	61	43	40	50	58	73
Pork pigs	73	45	52	60	66	74
Dairy cows	26	34	33	33	30	29
Store cattle	23	22	23	23	22	18
Store sheep	40	46	59	57	56	54
Store pigs	108	35	52	56	57	71
Eggs	37	37	56	68	93	45
Poultry	25	41	45	41	40	38
Milk	63	63	70	70	60	77
Butter	43	55	53	53	54	51
Cheese	36	78	78	74	74	76
Potatoes	60	94	31	29	40	15
Hay	-1*	11	6	4	7	10
Wool	34	71	72	69	60	59

*Decrease

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Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on May 7 and 14, at 7 Whitehall Place, London, S.W. 1, the Rt. Hon. The Viscount Ullswater, G.C.B., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying into effect these decisions :—

Beds and Hunts.—An Order to come into operation on May 13 and to continue in force until further notice varying the existing minimum and overtime rates so as to fix overtime rates for female workers. The minimum rate for male workers of 21 years of age and over is 30s. 6d. per week of 48 hours in winter and 50 in summer, with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays, Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and Boxing Day. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour with overtime at 7½d. per hour on weekdays and 9d. per hour on Sundays, Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and Boxing Day.

Dorset.—An Order cancelling as from May 18 the existing minimum and overtime rates of wages for male and female workers, and

fixing fresh rates in substitution therefor as from May 19, 1929, to operate until June 7, 1930. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week. The hours in respect of which the weekly minimum wage is payable are 51 in summer and 48 in winter except in the weeks in which public holidays fall. In the week comprising Christmas Day and Boxing Day the hours specified are 31, and in the weeks in which Good Friday, Easter Monday, Whit Monday and August Bank Holiday fall 42, with the addition in each case of not more than three hours' employment on milking and the care of and attendance upon stock on each of the above holidays. Overtime is payable in the case of male workers of 21 years of age and over at 8d. per hour. In the case of whole-time female workers of 21 years of age and over the minimum wage is 24s. per week. The hours in respect of which the weekly minimum wage is payable are 48 except in the weeks in which public holidays fall. In the week comprising Christmas Day and Boxing Day the hours specified are 31, and in the weeks in which Good Friday, Easter Monday, Whit Monday and August Bank Holiday fall 39½, with the addition in each case of not more than three hours' employment on milking and the care of and attendance upon stock on each of the above holidays. The overtime rate in the case of whole-time female workers of 20 years of age and over is 6d. per hour. In the case of part-time and casual female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6d. per hour.

Hampshire and Isle of Wight.—An Order fixing special differential rates of wages for overtime employment of male workers on the corn harvest in 1929, the rate in the case of male workers of 21 years of age and over being 9d. per hour.

Herefordshire.—An Order to come into operation on May 11 fixing minimum and overtime rates of wages for male and female workers to continue in force until further notice. The minimum rate in the case of male workers of 21 years of age and over employed wholly or mainly as bailiffs, waggoners, stockmen or shepherds is 36s. per week (including Sunday) for all time necessarily spent on the immediate care of animals (not exceeding 60 hours). In the case of other male workers of 21 years of age and over the minimum rate is 31s. per week of 54 hours in summer and 48 hours in winter. The overtime rates in the case of all classes of male workers of 21 years of age and over are 2d. per hour for all employment on Christmas Day and Good Friday, where a whole-time worker employed by the week or longer period has completed less than the full number of hours in respect of which the weekly minimum wage is payable and 9d. per hour for all other overtime employment. In the case of female workers of 18 years of age and over the minimum rate is 4½d. per hour with overtime at 1½d. per hour for employment on Christmas Day and Good Friday where a whole-time worker employed by the week or longer period has completed less than 46½ hours in the weeks in which those holidays fall and 6d. per hour for all other overtime employment.

Oxfordshire.—An Order to come into operation on May 13 and to continue in force until further notice varying the existing minimum and overtime rates so as to fix overtime rates for female workers. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 48 hours in winter and 50 hours in summer with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays, Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and Boxing Day. In the

case of female workers of 18 years of age and over the minimum rate is 6d. per hour with overtime at 7½d. per hour on weekdays and 9d. per hour on Sundays, Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and Boxing Day.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

Enforcement of Minimum Rates of Wages.— During the month ending May 15, legal proceedings were instituted against ten employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines		Costs		Arrears of wages		No. of workers involved
		£	s. d.	£	s. d.	£	s. d.	
Berks ..	Farringdon	5	0 0	—		7	3 7	3
Hants ..	Andover ..	1	0 0	—		20	18 6	1
Kent ..	Rochester .	2	10 0	—		21	18 0	5
" ..	Sevenoaks.	4	0 0	2	12 0	5	1 3	1
Lancs ..	Preston ..	9	0 0	2	2 0	33	0 0	3
Lincs ..	Grantham.	5	0 0	—		35	0 0	2
Salop ..	Bridgnorth	2	5 0	—		15	18 9	2
Sussex ..	Midhurst..	7	10 0	1	0 0	29	12 11	4
Yorks, W.R.	Leeds ..	5	0 0	3	3 0	22	17 8	1
Flint ..	St. Asaph .	1	0 0	0	7 6	1	7 11	1
		£42	5 0	£9	4 6	£192	18 7	23

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Foot-and-Mouth Disease.—The country continues free from outbreaks of foot-and-mouth disease, no case having been confirmed since that at Anerley, Penge, Kent, on March 24 last.

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NOTICES OF BOOKS

Agricultural Entomology. By D. H. Robinson, B.Sc., and S. G. Jary, B.A. Pp. xi + 314. (London: Duckworth & Co. 1929. Price 15s. net.)

In their preface to this book, the authors state that "nowadays a working knowledge of the subject of entomology is regarded as part of a farmer's equipment," and the book is intended to supply this knowledge to the students at Agricultural Colleges. There has long been a need for such a book in this country, and the present volume will go far to fill the gap.

The first few chapters deal briefly with the morphology, anatomy, metamorphoses and classification of insects generally; subsequently, individual insects of economic importance are dealt with under their respective Orders, their life-histories and the control measures adopted against them being briefly described. In subsequent chapters the general principles underlying insect control are discussed and the properties of some of the more common insecticides are given.

Those invertebrates of agricultural importance which are not true insects (*e.g.* mites, eelworms, slugs) but which come within the province of the economic entomologist, are dealt with in appendices.

The book is adequately illustrated by photographs and line drawings: it should be noted, however, that the titles of figures 70 and 72 have been interchanged.

In general, while the volume should fulfil the purpose for which it is written, there are a number of errors and omissions which should be corrected in a subsequent edition. For example, in the section on mites, *Eriophyes pyri*, *Oligonychus ulmi* and *Tetranychus telarius* are omitted. The Protection of Animals Act, referred to on page 200, was amended in 1927 in order to allow, in certain circumstances, the use of a poisonous bait for the destruction of noxious insects, while the hot water treatment of bulbs, referred to on page 213, as a possible control for *Merodon equestris*, was, in fact, originally devised as a measure against this pest, its use against the Stem Eelworm being a subsequent development.

* * * * *

Principles of Plant Pathology.—By Charles Elmer Owens. Pp. xii+629. (New York: John Wiley & Sons. London: Chapman & Hall, Ltd. 1928. Price 23s. 6d. net.)

The author of this volume is Associate Professor of Plant Pathology in the Oregon State Agricultural College, U.S.A., and the book is intended for use in schools of agriculture by undergraduates pursuing a one-term course in plant pathology. Professor Owens has had 15 years' experience in teaching the subject; and a perusal of the work will show that it is written by a teacher and, therefore, from the pedagogic standpoint rather than from that of the research worker. It by no means follows, however, that the book is less valuable on that account.

Part I consists of 13 chapters. The first two deal with the rise and development of modern plant pathology in an interesting and instructive way. Definition, symptoms, classification and the methods of investigation of plant diseases are next discussed, followed by their consideration in relation to environment. Four chapters deal with control, fungicides, disease-free seed and stock, and quarantine and inspection; one treats of soil sickness, another concerns disease resistance, and the last two in this section cover the relation of insects to plant diseases, and storage, transport and market problems, respectively.

Part II contains 12 chapters which, after dealing with methods of laboratory study, treat of specific diseases of agricultural and horticultural crops. The diseases are grouped according to the parasites that cause them, beginning with those due to *Myxomycetes*, following with those caused by bacteria and with those due to the various groups of fungi proper. There are, also, chapters on diseases caused by algæ, by parasitic flowering plants and by eelworms. Virus diseases are the subject of a chapter and, finally, there is another on non-parasitic diseases.

At the close of each chapter is a set of "Review Questions" that are rather reminiscent of the examination fiend, and that strike the present reviewer as being both unnecessary and undesirable. References to original literature are provided in convenient sections and in considerable abundance. The majority of them are, naturally, to publications in the U.S.A., and a little greater selective discrimination between the ephemeral and the fundamental would have been an advantage. Thus, to take a single example, there is no reference to the classical paper (1846) of Berkeley in connexion with potato blight. There are over 200 illustrations and nearly all are good, whilst there are laboratory instructions to assist the student in his work. One misses, unfortunately, any emphasis on the necessity for the study of diseases where they generally occur, viz., in the field.

The book, particularly Part I, can be recommended for perusal by students of plant diseases in this country, if only because so many of us are still "mycologists" rather than "plant pathologists," and our point of view requires widening; and, although many of the diseases dealt with in Part II do not closely concern us, yet a number of them are common to and are equally important in both the eastern and western hemispheres.

It would be easy for a critic to detect in the book minor blemishes or matters that fail to conform to his own idiosyncrasies. Thus, one does not approve of a word like "additioning" when "adding" exists; "immune to" instead of "immune from" is an all too common error nowadays; the peculiar use of the word "section" in the United States, as indicating an area of country, is, perhaps, gradually being apprehended here; a "deliquescent" type of branching will be unfamiliar to most people; *Pythium de Baryanum* (and *Phytophthora infestans*) "belongs to the class *Phycomycetes*, hence the mycelium is non-septate," will strike a mycologist as being a topsy-turvy statement; and so on. But major errors are conspicuous by their absence and, moreover, the matter is in most respects fully up-to-date.

The book, therefore, can be welcomed as an interesting and useful addition to the comparatively small number of text-books dealing with the teaching side of vegetable pathology; and, were its price not quite so high, it would probably find a permanent home on the shelves of many students in this country.

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SELECTED CONTENTS OF PERIODICALS

Agriculture, General and Miscellaneous

Can British Farmers Compete in Beef Production with Imports from Abroad? *Sir Wm. S. Haldane*. (Jour. Farmers' Club, 1928, Part 6 (December), pp. 107-125.) [338.1 (42); 63.62; 63.75.]

Weeds in the Economy of Agriculture. *H. C. Long*. (Science Progress, xxiii, 91 (Jan., 1928), pp. 487-490.) [63.259.]

Mole Drainage: Up-to-date Methods and Problems. *D. T. Thring*. (Jour. Land Agents' Soc., xxviii, 1 (Jan., 1929), pp. 8-15.) [63.14.]

Reclamation of Peat Land in Northern Europe. *W. G. Ogg*. (Scottish Jour. Agric., xii, 1 (Jan., 1929), pp. 5-20.) [63.12.]

Statistics and their Relation to Agricultural Interests. *W. N. Paton*. (New Zealand Jour. Agric., xxxvii, 6 (Dec. 20, 1928), pp. 398-401.) [311.]

Nitrogen Fixation: The Growth of a New British Industry. (Nature, Vol. 123, No. 3088 (Jan. 5, 1929), pp. 18-20, and No. 3089 (Jan. 12, 1929), pp. 51-54.) [668.6.]

A Hydro-Electric Farm Installation. *M. E. Haldane*. (Scottish Jour. Agric., xii, 1 (Jan., 1929), pp. 21-26.) [63.17.]

Jethro Tull and the "New Husbandry" of the Eighteenth Century. *T. H. Marshall*. (Econ. Hist. Rev., ii, 1 (Jan., 1929), pp. 41-60.) [63; 63 (09).]

The Crofting Problem, 1780-1883: VII, The Decline of Sheep Farming and Increase of Deer Forests; VIII, Events Leading up to the Appointment of the Crofters' Commission of 1883. *Margaret M. Leigh*. (Scottish Jour. Agric., xii, 1 (Jan., 1929), pp. 34-39.) [63 (41); 63 (09).]

Farming in Australasia: Its Bearing on British Farming. *Sir John Russell*. (Jour. Farmers' Club, 1929, Part 2 (March), pp. 21-40.) [63 (9).]

Tenure of Agricultural Land in Norway. *P. Borgedal*. (Jour. Cent. Landowners' Assn., xxi, 1 (March, 1929), pp. 46-51.) [333.5 (48).]

Biology and Refrigeration. *Franklin Kidd*. I, Refrigeration in Nature (Jour. Roy. Soc. Arts, LXXVII (Jan. 25, 1929), pp. 269-285; II, Refrigeration and Fruit (Jour. Roy. Soc. Arts, LXXVII (Feb. 1, 1929), pp. 288-306); III, Refrigeration and Meat: With an Introduction on Atmosphere Control in Fruit Storage. (Jour. Roy. Soc. Arts, LXXVII (Feb. 8, 1929), pp. 313-339). [664.8.]

Soils and Fertilizers

The Hydrogen Peroxide-Hydrochloric Acid Treatment of Soils as a Method of Dispersion in Mechanical Analysis. *G. B. Bodman*. (Soil Sci., xxvi, 6 (Dec., 1928), pp. 459-470.) [63.113.]

The Dispersion and Mechanical Analysis of Heavy Alkaline Soils. *A. F. Joseph* and *O. W. Snow*. (Jour. Agric. Sci., xix, 1 (Jan., 1929), pp. 106-120.) [63.113.]

The Properties of Heavy Alkaline Soils containing different Exchangeable Bases. *A. F. Joseph* and *H. B. Oakley*. (Jour. Agric. Sci., xix, 1 (Jan., 1929), pp. 121-131.) [63.112.]

On the Influence of the Carbon: Nitrogen Ratios of Organic Materials on the Mineralisation of Nitrogen. *H. L. Jensen*. (Jour. Agric. Sci., xix, 1 (Jan., 1929), pp. 71-82.) [63.16; 63.1671.]

Liming as a Factor in the Amelioration of Deteriorated Tropical Soils. *P. E. Turner*. (Jour. Agric. Sci., xix, 1 (Jan., 1929), pp. 83-89.) [63.15.]

Studies in the Geology and Mineralogy of Soils: I, A Detailed Study of a Region Characterized by Diverse Rocks and Partly Covered by Glacial Drift. *R. Hart*. (Jour. Agric. Sci., xix, 1 (Jan., 1929), pp. 90-105.) [55; 63.111.]

Soil Acidity considered from the Point of View of Base Exchange and Hydrogen Ion Concentration. *P. H. Gallagher*. (Jour. Irish Dept. Agric., xxviii, 1, pp. 75-106.) [63.113; 63.161.]

A Rapid Electrometric Method for Measuring "Lime Requirements" of Soils. *F. Hardy* and *A. H. Lewis*. (Jour. Agric. Sci., xix, 1 (Jan., 1929), pp. 17-25.) [63.113.]

Soil Bacteria and Fertility. *P. H. B. Gray*. (Science Progress, xxiii, 91 (Jan., 1928), pp. 444-456.) [63.115; 63.16.]

Sewage Sludge as a Fertilizer. *W. Rudolfs*. (Soil Sci., xxvi, 6 (Dec., 1928), pp. 455-458.) [63.164.]

Field Crops

The Nature of Certain "Rogues" found among Crops of Swede Turnips in Ireland. *H. A. Lafferty*. (Jour. Irish Dept. Agric., xxviii, 1, pp. 30-36+6 pl.) [63.332.]

Comparative Agronomic Values of Red and White Clovers of Different Origin. *R. D. Williams*. (Jour. Irish Dept. Agric., xxviii, 1, pp. 67-74.) [63.33.]

The Phosphate Requirement of Barley at Different Periods of Growth. *W. E. Brenchley*. (Ann. Bot., xliii, 169 (Jan., 1929), pp. 89-109.) [63.161; 63.313.]

Physiological Studies in Plant Nutrition: I, The Effect of Manurial Deficiency on the Respiration and Assimilation Rate in Barley. *F. G. Gregory* and *F. J. Richards*. (Ann. Bot., xliii, 169 (Jan., 1929), pp. 119-161.) [63.161; 63.313.]

- A Preliminary Note on the Effect of Sodium Silicate in Increasing the Yield of Barley. *R. A. Fisher*. (Jour. Agric. Sci., xix, 1 (Jan., 1929), pp. 132-139.) [63.167; 63.313.]
- Use of Water by Cultivated Plants in the Field. *N. Tulaiikov*. (Jour. Agric. Sci., xix, 1 (Jan., 1929), pp. 1-16.) [63.3.]
- Some Potato-breeding Problems. *W. Robb*. (Scottish Jour. Agric., xii, 1 (Jan., 1929), pp. 46-53.) [63.1952; 63.512.]
- The "Inoculation" of Lucerne (*Medicago sativa* L.) in Great Britain. *H. G. Thornton*. (Jour. Agric. Sci., xix, 1 (Jan., 1929), pp. 48-70.) [576.83; 63.33.]
- Nitrogenous Fertilizing and Rotational Grazing of Pastures: Experiment in Piako County, Season, 1927-28. *G. W. Wild*. (New Zealand Jour. Agric., xxxvii, 6 (Dec. 20, 1928), pp. 363-372.) [63.33; 63.33-16.]

Fruit Growing

- The Economics of Fruit Growing in England. *W. P. Seabrook*. (Jour. Farmers' Club 1929, Part 1 (February), pp. 2-20.) [63.41 (42).]
- The Study of the Order of Flowering and Pollination of Fruit Blossoms applied to Commercial Fruit Growing. *C. H. Hooper*. (Jour. Roy. Soc. Arts, lxxvii, 3981 (March 8, 1929), pp. 424-442.) [63.41.]

Plant Pests and Diseases and Remedies

- Bitter Pit in Apples: Some Recent Investigations. *W. M. Carne*. (Jour. Coun. Sci. and Indust. Res. (Australia), i, 6 (Nov., 1928), pp. 358-365.) [63.21.]
- Studies on Potato Virus Diseases: IV, Further Experiments with Potato Mosaic. *K. M. Smith*. (Ann. App. Biol., xvi, 1 (Feb., 1929), pp. 1-33, pl. i-v.) [63.23.]
- On Two Cases of Recovery from a Mosaic Disease of Tomato Plants, *Lycopersicum esculentum*. *L. Verwoerd*. (Ann. App. Biol., xvi, 1 (Feb., 1929), pp. 34-39.) [63.23.]
- Studies of Wood-destroying Fungi: I, *Polyporus hispidus* (Fries). *F. J. Nutman*. (Ann. App. Biol., xvi, 1 (Feb., 1929), pp. 40-64, pl. vi-viii.) [63.24.]
- The Biology of Oat Smuts: II, Varietal Resistance. *K. Sampson*. (Ann. App. Biol., xvi, 1 (Feb., 1929), pp. 65-85, pl. ix.) [63.24.]
- The Control of "Bunt" in Wheat. *W. A. R. Dillon Weston*. (Ann. App. Biol., xvi, 1 (Feb., 1929), pp. 86-92.) [63.24.]
- The Action of Certain Chemical Substances on the Zoospores of *Pseudoperonospora humuli* (Miy. et Takah.) Wils. *W. Goodwin*, *E. S. Salmon* and *W. M. Ware*. (Jour. Agric. Sci., xix, 1 (Jan., 1929), pp. 185-200.) [63.24.]
- The Greenhouse White-Fly. *E. R. Speyer*. (Jour. Roy. Hort. Soc., liv, 1 (Jan., 1929), pp. 181-192+9 pl.) [63.27.]
- The Rhododendron White Fly (Contributions from the Wisley Laboratory, LIII). *G. Fox Wilson*. (Jour. Roy. Hort. Soc., liv, 1 (Jan., 1929), pp. 214-217.) [63.27.]
- On the Occurrence of the Parthenogenetic and Sexual Forms in *Aphis rumicis* L., with Special Reference to the Influence of Environmental Factors. *J. Davidson*. (Ann. App. Biol., xvi, 1 (Feb., 1929), pp. 104-134.) [63.27.]
- Studies on *Oscinella frit* Linn.: A Report on Certain Oat Varieties in relation to their resistance to attack by the Frit Fly in Sweden, together with data concerning the production of

- resistant utility varieties. *N. Cunliffe*. (Ann. App. Biol., xvi, 1 (Feb., 1929), pp. 135-170.) [63.27; 63.314.]
- Oat-sick Land in relation to Eelworm Disease. *D. Robertson*. (Scottish Jour. Agric., xii, 1 (Jan., 1929), pp. 40-45.) [63.27; 63.314.]
- The Action of Sulphur as a Fungicide and as an Acaricide, II. *Wm. Goodwin* and *H. Martin*. (Ann. App. Biol., xvi, 1 (Feb., 1929), pp. 93-103.) [63.295.]
- On the Relative Value of Parasites and Predators in the Biological Control of Insect Pests. *W. R. Thompson*. (Bull. Ent. Res., xix, 4 (March, 1929), pp. 343-350.) [63.29; 63.296.]

Live Stock and Feeding

- Live Stock Improvement and the Live Stock Shows. *J. A. Scott Watson*. (Scottish Jour. Agric., xii, 1 (Jan., 1929), pp. 1-5.) [63 (064); 63.60.]
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- Mineral Hunger in Sheep: Successful Treatment by Pellet-Feeding Method. *B. C. Aston*. (New Zealand Jour. Agric., xxxviii, 1 (Jan 21, 1929), pp. 10-16.) [612.394; 63.631 : 043; 63.60432.]
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THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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NOTES FOR THE MONTH

INFORMATION available in March last indicated that the world's production of wheat (exclusive of Russia) in the current season, on the estimates then available, was likely to exceed that of 1927-28 by some 144 million cwt. or 8 per cent., and to be in excess of the average by as much as 259 million cwt. or 15 per cent. Subsequent revisions in official crop estimates have had no appreciable effect on these figures, and it is clear that the total yield this season has been exceptionally heavy. Moreover the increase in output assumes much greater significance when viewed in the light of the quantity of wheat entering into international trade, which in the three seasons ended 1927-28 is estimated to have averaged approximately 410 million cwt.; in fact, the International Institute of Agriculture considers that the quantity of wheat available for export in the current season from exporting countries will exceed the amount likely to be required by importing countries by very nearly 200 million cwt. This surplus is exceptionally large, the corresponding figures for the three previous seasons being as follows: In the 1927-28 season 120 million cwt., in 1926-27 100 million cwt. and in 1925-26 65 million cwt. Trade estimates of the surplus in the current season, viz., 175 million cwt. by the *London Grain Seed and Oil Reporter* and 190 million cwt. by the *Corn Trade News*, are slightly smaller than the calculation of the International Institute, but are confirmatory of the existence of very large supplies.

In view of the heavy quantities of wheat available it is only natural that prices should be at a low level, particularly with the prospect of another large winter crop in the United States, and it is perhaps somewhat surprising that prices were maintained as well as they were until a few weeks ago. The extent of the recent decline will be seen from the table overleaf of weekly average prices of July futures at the more important markets.

At Chicago, where the price movement has no doubt been influenced by the satisfactory outlook for the forthcoming

Week ended	Chicago	Winnipeg	Buenos Aires	Liverpool
1929	s. d.	s. d.	s. d.	s. d.
March 20.. ..	10 1	10 1	8 11	10 7
„ 27.. ..	9 8	9 10	8 9	10 4
April 3.. ..	9 6	9 9	8 9	10 4
„ 10.. ..	9 6	9 8	8 8	10 3
„ 17.. ..	9 7	9 9	8 8	10 3
„ 24.. ..	9 2	9 5	8 5	10 0
May 1.. ..	9 0	9 5	8 5*	9 9
„ 8.. ..	8 10	9 2	8 1*	9 5
„ 15.. ..	8 4	8 9	7 10*	9 0
„ 22.. ..	8 2	8 9	7 10*	9 0
„ 29.. ..	7 11	8 6	7 6*	8 11
June 5.. ..	7 11	8 5	7 4	8 8
„ 12.. ..	8 3	8 10	7 6	8 11
„ 19.. ..	8 3	8 10	7 6	8 10

* August futures.

winter wheat crop, prices dropped between the latter part of March and the beginning of June by over 20 per cent., but have since made some slight recovery. At other markets, the trend of prices has been the same as at Chicago, although the fall has been rather less severe. In March and April of last year, prices were rising owing to the poor crop prospects at that time in the United States; and the present price level shows a reduction on the year of 2s. 3d. per cwt. at Chicago, 1s. 6d. at Winnipeg, 2s. 5d. at Buenos Aires, and 2s. 5d. at Liverpool. It is interesting to note that the *London Grain, Seed and Oil Reporter* stated that the price of May wheat at Chicago on May 27 was the lowest reached by that future in May of any year since pre-war days. A comparison of prices at Liverpool gives much the same result, the price of 8s. 8d. per cwt. as shown (June 5) in the above table being the lowest for the time of year since the war, and being only 6d. per cwt. higher than the average price in early June of the three years 1911-13.

British wheat so far does not appear to have been affected to any large extent by the recent declines in the futures markets, the average price in March having been 9s. 8d. with increases to 9s. 10d. in April and 9s. 11d. in May, while the latest weekly average (relating to returns received in the week ended June 22) is 9s. 7d. per cwt.

From now onwards wheat prices will tend to be increasingly affected by the prospects of the crops of 1929-30, and the following remarks summarize briefly the available information in this connexion.

United States.—In the May official report the area under winter wheat remaining to be harvested is estimated at

40,467,000 acres, which indicates that 6.4 per cent. of the area sown last autumn has been "winter-killed." This is the lowest rate of winter-killing for eight years. The official report adds that the condition of the crop on May 1 indicated a likely production of very nearly 320 million cwt., which is some 58 million cwt. more than the estimate of the previous May, although only about 9 million in excess of the final estimate of the 1928 crop. The outlook for spring wheat, however, appears less favourable, sowings having been delayed by excessive rains.

Canada.—According to trade reports sowing of spring wheat has been completed, and the crop outlook appears on the whole to be satisfactory. It is generally considered that June is the critical month for the Canadian crop.

Europe.—Latest reports, which, however, are still incomplete, indicate a net increase of nearly 900,000 acres in the area under wheat, representing mainly more extended sowings in Spain and the Serb-Croat-Slovene State. The severe winter and the lack of sunshine in April resulted in crops being backward, although with the more seasonable weather in May crop prospects have improved.

North Africa.—Crop prospects are reported to be favourable.

India.—The crop recently secured is estimated at 168 million cwt., which is 13 million cwt. in excess of last year's poor yield, although 17 million less than the five year average. On the average consumption in the five seasons ended 1927-28 the latest crop is slightly below home requirements.

Argentina and Australia.—Sowing of the new crops (for harvest towards the close of 1929) has been hampered by droughty conditions.

* * * * *

(1) The Ministry of Health has had under consideration the scope of the byelaws relating to accommodation provided for hop-pickers, and after consultation with the Ministry of Agriculture and Fisheries and the National Farmers' Union and also with representatives of Local Authorities, has circulated the following model byelaw* dealing with the provision of means of escape from fire.

**Accommodation
for Hop Pickers**

Every person who for persons engaged in hop-picking or in the picking of fruit and vegetables provides any lodging not ordinarily occupied for human habitation shall, where any part of the lodging

* This model byelaw has been added to the 1926 model series which was printed in full in the August, 1926, issue of this JOURNAL.

which is above the ground floor may be intended to be used for sleeping.

(a) cause that part to be provided with adequate access from and to the level of the ground by a stairway or stairways ["stairway" is used here to describe a means of access with flat treads, i.e., something more than a ladder with rungs. The word does not imply what is known in building as a "staircase."];

(b) cause to be provided in connexion with any such part which may be used by more than.....† persons at least two means of access extending to the level of the ground, one at least of which shall be approached by a door opening outwards from within on to a proper landing;

[† "fifteen" has been suggested here, but if the Local Authority consider this too high, the Minister of Health will agree to ten, or some intermediate figure.]

(c) cause all means of access (including any stairs and landings) to be substantially constructed.

(2) The Ministry of Health points out that it will be realized that a byelaw, which is a legal enactment enforceable by penalties, cannot properly include all the precautions which are desirable in many cases. The following supplementary list of desirable precautions has been circulated to Local Authorities with the suggestion that it should be communicated to the persons by whom lodgings for hop-pickers are provided:—

Recommendations as to Precautions against Fire and as to other Improvements in Hop-pickers' Camps.—Reports on inspections of camps made during the last season by officers of the Ministry and of local authorities disclose in some cases the existence of unsatisfactory conditions, even where full series of byelaws were in force. The Ministry of Health has reason to think that hop-growers would generally be quite willing to make better arrangements if their attention were drawn to the requisite measures before the beginning of the season. It is suggested that the following recommendations (some of which relate to matters not covered by the byelaws) should be brought to their notice:—

(1) *Prevention of Fire.*—Many hop-growers have realized the danger of fire where loose straw is used as bedding, and have endeavoured to guard against it by the provision either of electric light or of safety lamps. It is hoped that this practice will become general. The use in such surroundings of any form of lamp in which a naked flame is exposed or which is liable to be upset is obviously dangerous. The striking of matches or the use of emergency lights in cases of this kind must be attended with danger, and in many cases it would be desirable that some safe light, to be kept burning all night, should be provided.

Where young children are left unattended suitable precautions should be taken to prevent them from accidentally starting a fire. It is desirable that hop-pickers should be warned of the dangers of fire.

In exceptional cases, such for example as three-storied buildings used for the accommodation of hop-pickers, additional care and special precautions will obviously be desirable.

(2) *Situation and Arrangement of Camp.*—Care should be exercised at the outset in choosing the site as mistakes may prove expensive. It is essential to avoid situations liable to flooding. The proximity of ponds, ditches, or uncleared brushwood is also

undesirable as accumulations of refuse in these may cause a nuisance.

(3) *Latrines*.—Complaints of defective sanitary accommodation in hop-pickers' camps are not uncommon, and it appears from the reports of the Minister's Inspectors that unsatisfactory conditions in certain camps are due to a lack of recognition of the need for proper construction of field latrines and the maintenance of constant supervision so long as the camp is occupied.

In a report of the Kent County Medical Officer of Health, dated January 6, 1929, reference is made to a form of pit latrine with a portable shelter in use in the Hollingbourn Rural District, Kent, which appears to have certain advantages. Further information in regard to this form of latrine may be obtained on application to the Sanitary Inspector, Hollingbourn Rural District Council, 33 Earl Street, Maidstone, Kent.

Care should be taken that latrines are not so placed as to be likely to foul any water supply.

(4) *Camp Scavenging*.—In many camps the farmer employs a camp superintendent, who is charged with such duties as the maintenance of latrines in usual condition, the removal of refuse, the control of water supplies and supervision of safeguards against fire. In some cases these duties are entrusted to one of the hop-pickers. It is very desirable that some such arrangement for systematic supervision should be made in all cases.

Portable refuse bins should be provided in order to facilitate the daily removal of refuse.

* * * * *

THE second of a new series of Annual Reports on the work of the Land Division of the Ministry has recently been published. The Report includes, *inter alia*,

Report of the sections dealing with proceedings under
Land Division the following Statutes: Small Holdings
and Allotments Acts, 1908 to 1926;

Small Holding Colonies Acts, 1916 and 1918, and the Sailors and Soldiers (Gifts for Land Settlement) Act, 1916; Improvement of Land Acts; Universities and College Estates Act, 1925; Glebe Lands Act, 1888; Agricultural Holdings Act, 1923, and the Ministry of Agriculture and Fisheries Act, 1919. Other miscellaneous activities of the Ministry which are reported include those connected with (a) the destruction of rats and mice and other land pests; (b) the issue of certificates as to obtaining possession of agricultural cottages in certain cases; and (c) the destruction of injurious weeds.

The Small Holdings Section of the Report is devoted mainly to an account of the first year's operations under the Small Holdings and Allotments Act, 1926. Full particulars are given of the acquisition of additional land by County Councils for small holdings or cottage holdings, the equipment of existing holdings, and the advance of loans to persons purchasing holdings from private owners. The position and prospects

of the men settled on small holdings prior to 1926 are also briefly reviewed and an appendix to the Report gives an account of a number of outstanding successes among these earlier settlers.

The section of the Report which deals with allotments includes an analysis of the returns received from allotment authorities at the end of 1927. These show a further small decrease in the total number and area of allotments under cultivation in England and Wales, though the area of land *owned* by allotment authorities has slightly increased.

The proceedings of the Ministry under the Small Holdings Colonies Acts and the Sailors and Soldiers (Gifts for Land Settlement) Act are dealt with in a further section, which contains an account of the administration during the year of the six farm settlements under the control of the Ministry. These include one profit-sharing farm and five small holding settlements, and the Report includes interesting details of the sub-division of these estates and the areas under different crops, etc. Brief notes on a number of the more successful tenants are also included.

The Report on the Improvement of Land Acts deals with applications by landowners under those Acts for the issue of Orders charging their estates with the cost of various works of improvement, details of which must be submitted for the approval of the Ministry before the work is executed.

A further section of the Report deals with the subject of the extinguishment of manorial incidents consequent upon the coming into operation on January 1, 1926, of the Property Acts, 1922 and 1924, while other sections dealing with the Property Acts relate to the redemption and apportionment of rents, and the conversion of perpetually renewable leases into long terms.

The report gives particulars of the commons placed under regulation during the year and of the inclosure for special purposes of portions of commons carried out with the Minister's approval. This section of the Report also refers to the deeds of declaration which were deposited during the year with the Ministry under the Law of Property Act, 1925, the effect of which was to confer upon the public rights of access to the commons concerned for air and exercise. The total area of commons affected by the deposit of deeds under this section up to the end of 1927 was 4,963 acres.

A section of the Report gives particulars of the transactions effected under the Universities and College Estates Acts, and reference is made to the fact that, with one exception, more

money was invested by universities and colleges in the purchase of property during 1927 than in any other year since 1890.

Another section of the Report gives the number of appointments of arbitrators made, and of orders issued by the Ministry since 1915 under the provisions of the Acts affecting agricultural holdings.

The Report deals with the constitution of agricultural committees established in accordance with the provisions of the Ministry of Agriculture and Fisheries Act, 1919, and particulars are given of the exercise by the committees of their powers relating to certificates under the Rent Restrictions Acts and the destruction of injurious weeds.

Under the heading of "Miscellaneous Activities" is included a section dealing with the subject of the destruction of rats and mice. In connexion with the national "Rat Week" campaign organized annually in November by the Ministry, short summaries are included from typical reports made by local authorities upon whom the duty of executing and enforcing the provisions of the Rats and Mice (Destruction) Act, 1919, is imposed.

* * * * *

THE Eighth International Dairy Cattle Judging Competition for Young Farmers' Clubs, for possession, for the ensuing year, of the *Daily Mail* Gold Challenge Cup, took place, by courtesy of the Show Committee, at the Sussex County Show at Brighton, on Thursday, June 13, 1929. Of the seven previous contests America has won four and England three. The competing teams, the respective champions of the Young Farmers' Clubs in this country and of the corresponding 4-H Clubs in the United States of America, were as follows:—

<i>England.</i>	<i>United States of America.</i>
<i>Buckingham Royal Latin School Calf Club.</i>	<i>Oklahoma State Dairy Club.</i>

Margaret James (age 15).	Forrest K. Burns (age 17).
Arthur William Culley (age 16).	Holland Williams (age 18).
Thomas William Curtis (age 17).	Harold Woodson (age 17).
(Leader, Mr. W. H. Thomas.)	(Leader, Mr. J. W. Boehr.)

The competition took place in fine weather and attracted a large gathering of spectators. For the first time in the contests, classes of heifers were put up for judging in addition to cows, the competitors being called upon to place and to give their

reasons for placing six rings, each of four animals, of heifers and cows of the Dairy Shorthorn, British Friesian and Guernsey breeds. A maximum of 50 points was allocated for placing the animals in each ring in order of merit, and a further 50 points for giving satisfactory reasons for the placing.

The judges were Mr. E. W. Amos, Mr. Allan Skelton and Professor J. A. Scott-Watson. The United States were invited to appoint a judge and an umpire in addition, but were unable, in the time available, to secure the services of persons able to act.

The American team succeeded in winning the Cup by a margin of 121 points, being awarded 1,337 (maximum 1,800) against England's 1,216. The individual scores were :—

Oklahoma State Dairy Club.

*Buckingham Royal Latin
School Calf Club.*

Holland Williams	..	459	Thomas William Curtis.	428
Harold Woodson	..	440	Margaret James	.. 395
Forrest K. Burns	..	438	Arthur William Culley .	393

Total 1,337

Total 1,216

Professor Watson, at the close of the competition, congratulated America on their win and both teams on an excellent performance with difficult rings of cattle.

Sir Charles J. Howell Thomas, Secretary to the Ministry of Agriculture and Fisheries, presented the Cup and silver medals awarded by the *Daily Mail* to the winning team, and bronze medals to the members of the unsuccessful team.

* * * * *

ARRANGEMENTS have now been completed for the Agricultural Section of the Empire Meteorological Conference which, as announced in the April issue of this JOURNAL, will be held next month (August). The Section will devote three days, August 28-30, to formal proceedings, and two days, August 31 and September 2, to visits. The first day's discussions will be common to the agricultural and general sections, and will relate to seasonal forecasting and general climatology ; those on the second day will be concerned with plant physiology and fruit growing in relation to weather conditions ; while the third day's proceedings will relate to the effect of weather on insect and fungus pests, and the improvement of crop forecasting by the use of meteorological data.

**Empire
Agricultural
Meteorology**



An American competitor giving reasons for his placings.

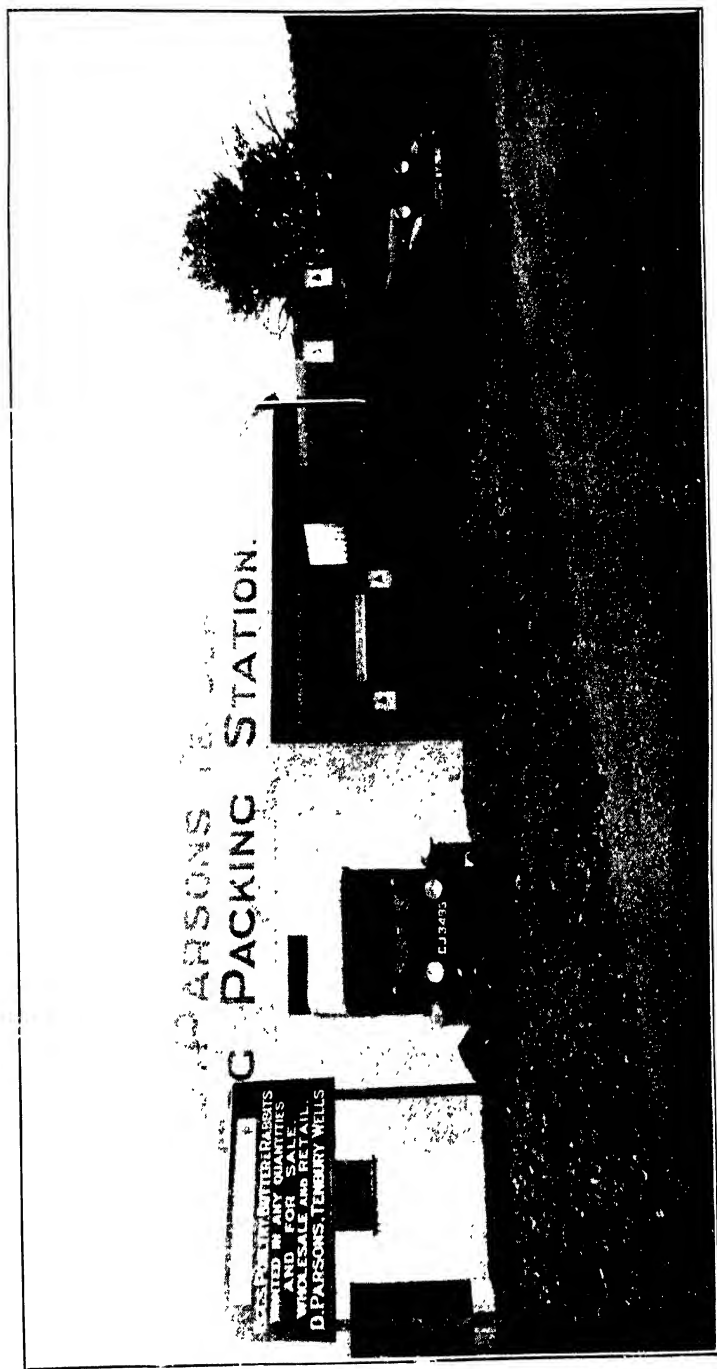


Judging the Guernsey Cows.



An English competitor giving reasons for his placings.
YOUNG FARMERS' CLUBS INTERNATIONAL DAIRY CATTLE JUDGING
COMPETITION, 1929.

To face page 312.



View of new egg packing station at Tenbury, Wales.

MARKETING UNDER THE NATIONAL MARK.



An early consignment of National Mark Tomatoes at Covent Garden Market.

MARKETING UNDER THE NATIONAL MARK.

The visits to be paid will be to the Royal Horticultural Society's Gardens at Wisley, the Lord Wandsworth Agricultural College, and the Rothamsted Experimental Station, to inspect the agricultural and horticultural investigational work in relation to meteorology carried on at these three centres. The first two centres will be taken on August 31 and Rothamsted on September 2.

* * * * * *

(1) *Eggs*.—During the last few weeks the National Mark Egg Scheme has undergone a period of testing. During the latter part of May and early June, the **Marketing under the National Mark** market slumped, and low prices, coupled with a narrow margin between National Mark and ungraded eggs, made conditions difficult for registered packers. Now, however, prices have hardened and National Mark supplies, owing to their guarantee of quality and service, have secured for themselves an unassailable position on the wholesale market.

The past few weeks have been a period of consolidation rather than of rapid expansion, but promising developments are reported from several quarters. In the south-western counties, where the number of registered packers is relatively high, the progress is particularly encouraging; packing stations show a marked improvement in technique and organization, and producers' prices have been influenced favourably. In the northern counties there has been a decided forward movement, particularly in the sphere of co-operative effort. In the East Riding of Yorkshire, a co-operative producers' station at Beverley, under the auspices of the National Farmers' Union, is in process of formation, at Darlington, the packing station of the Teesside Farmers, Ltd., will shortly be officially opened; while the Sheffield and North Derbyshire Poultry Farmers' Association, Ltd., also a farmers' co-operative venture, is completing the equipment of its depot at Coal Aston, near Sheffield. Developments are also proceeding in north-west Yorkshire and in east Lancashire. Meanwhile, concerted action on the part of the local branches of the National Farmers' Union and of the Grocers' Federation in various parts of the country is leading to the organization of National Mark Egg Weeks in a number of consuming centres.

Hitherto, Wales has not been adequately represented on the list of registered packers, but it is hoped that the official opening on June 28 of the packing station of the Clynderwen and District Farmers' Association, Ltd., Carmarthen, as a

demonstration centre for the Principality, will have the effect of arousing keener interest in the Scheme.

Reports of interesting advances are also received from other areas, and the accompanying photograph shows the new building which one of the registered packers has found it advisable to erect in order to cope with his increased turnover. A number of packers have taken the opportunity afforded by the various County Agricultural Shows to stage demonstrations of grading and packing under the Mark from their private stands in the show grounds, and reports received indicate that, in some instances at any rate, good business has resulted. The prominence given to the Scheme in the "National Mark Hall" at the Ministry's marketing demonstrations this summer has been helpful in keeping the Scheme before the notice of producers generally.

The Metropolitan Asylums Board have again specified National Mark "Standards" on renewing their egg contracts for the three months July-September, 1929; the total quantity of eggs contracted for during this period is 64,000 dozen.

(2) *Tomatoes and Cucumbers*.—The well-organized glasshouse section of the fruit-growing industry has been quick to follow in the wake of the apple and pear growers and seize the opportunity afforded by the National Mark. Within the few weeks which have elapsed since the inception of the Tomato and Cucumber Scheme, over 70 tomato growers and 25 cucumber growers have become authorized packers. These represent an area of approximately 200 acres under glass, and include a number of the largest growers of tomatoes and cucumbers in the country. Their produce, packed under the Mark, is now to be seen on most of the large wholesale fruit and vegetable markets, and the accompanying photograph shows one of the earliest consignments of tomatoes which arrived at Covent Garden on May 31. Good prices are reported as having been received for National Mark supplies.

The Ministry arranged for a film to be taken by the Gaumont Company depicting tomato and cucumber culture at the glass houses of a prominent Lea Valley grower, and the grading and packing of the fruits under the National Mark Scheme. The film was released at the end of June in the "Gaumont Mirror" and is being shown at over 1,000 picture theatres throughout the country.

(3) *Other Commodities*.—A brief reference to some of the other commodities which are being considered in connexion with National Mark Schemes may be of interest.

Beef.—Considerable progress has been made with the scheme for the grading and marking of home-produced beef. Consultation has been proceeding between the Ministry, the National Farmers' Union, and the distributive trades, and definitions of the proposed grades have been drawn up. It is hoped that a trial scheme of a limited nature may be launched in the autumn.

Poultry.—The grades, packs and packages for dressed poultry which have been demonstrated tentatively by the Ministry at agricultural shows during the past two years are being carefully examined with the help of an informal committee representing trade interests, and it is hoped to formulate a National Mark Scheme for submission to the Poultry Advisory Committee at an early date.

Flour.—Consideration is also being given to the possibility of applying the National Mark to all-English flour. Meetings are being held for the purpose between representatives of the Ministry and the National Association of British and Irish Millers, and provisional agreement has been reached on a number of issues. It seems probable that three grades will be formulated: (1) all-English Yeoman wheat flour for bread-making purposes; (2) all-English flour for biscuit-making and household use; and (3) all-English self-raising flour for scaling. The precise factors involved in the definition of the grades have not, as yet, been determined, but these will no doubt be agreed upon shortly.

Malt Products.—The possibility of devising workable standards of quality for all-English malt extracts and malt flour, with the object of applying a National Mark Scheme to these commodities, is also being examined. The Association of Malted Products Manufacturers is inclined to the opinion that the market for English barley can be improved in this way, and a small informal committee has been appointed to inquire fully into the matter with the Ministry.

Canned Fruits.—On the suggestion of the National Farmers' Union and of the Standing Committee on Marketing of the Council of Agriculture, a preliminary conference has taken place between representatives of the National Food Canning Council, the National Farmers' Union and the Ministry on the question of defining standards of quality and packing for canned home-grown fruit and vegetables, as a preliminary to introducing a National Mark Scheme for this important and rapidly expanding industry. Time is too short to bring a scheme into operation in the present season, but discussions

are to be continued and there is every reason to hope that the National Mark as a powerful aid to selling will be at the disposal of the home canning industry in 1930.

* * * * *

VOLUME XII of the Ministry's Register of Dairy Cattle, published last month, contains particulars of 7,500 cows selected on their milk yields during the

Register of year ended October 1, 1928. For a cow
Dairy Cattle to be eligible for entry in the Register its milk yield must not be less than the standard prescribed for its breed or type. The standard yields are as follows :—

Friesian	10,000 lb.
Ayrshire, Blue Albion, Lincoln Red Shorthorn, Red Poll, and Shorthorn..	9,000 lb.
All other breeds or types	8,000 lb.

The number of entries in the Register was restricted to 7,500, which allowed for the inclusion of only 55 per cent. of the total number of cows eligible. Of the cows entered, 19 gave over 20,000 lb. of milk during the year; 224 between 15,000 and 20,000 lb.; 655 between 13,000 and 15,000 lb.; and 2,800 between 11,000 and 13,000 lb., most of the remaining 3,802 giving over 10,000 lb. Twenty recognized breeds or types are represented in the volume, 56 per cent. being of the Shorthorn type, 22 per cent. Friesian, and 5 per cent. Guernsey. A statement is given showing the number of cows of each breed eligible for entry in the Register, the number and distribution of the yields of the cows of each breed entered, and the lowest yields entered for the principal breeds.

A list of 255 cows in respect of which certificates of merit have been awarded is also included in the Register. To be normally eligible for a certificate of merit, a cow must have calved not less than three times during a period of three consecutive milk-recording years, and have given during those years not less than the prescribed yield of milk, which for the three years ended October 1, 1928, was 30,000 lb. for Friesians, 27,000 lb. for Ayrshires, Blue Albions, Lincoln Red Shorthorns, Red Polls, and Shorthorns; and 24,000 lb. for all other breeds or types.

Particulars are given of pedigree bulls of proved milking strain. The condition of entry of a bull in this Section of the Register is either (a) that its dam and sire's dam must have given the standard yield prescribed for their breed or type during a milk-recording year, or (b) that it has two or more

daughters which have given not less than the standard yield prescribed for their breed or type in a milk-recording year. Entries relating to 122 bulls are given in the volume, 80 of which qualified under condition (a) and 42 under condition (b).

An up-to-date list of the Milk Recording Societies in England and Wales, with particulars of each Society and the name and address of the Secretary, is included in the Register.

Dairy farmers and others desirous of acquiring pedigree or non-pedigree animals with authenticated milk records will find the Register a valuable book of reference.

The Register is priced 1s. post free, and can be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, or through any bookseller. A copy of the volume is issued free to all members of Milk Recording Societies.

* * * * *

ALTHOUGH the World's Poultry Congress to be held at the Crystal Palace in July, 1930, is still a year off, delegates and members are already being registered,

World's Poultry Congress, 1930 and many applications have been received for space in the commercial and livestock sections of the Exhibition which is to be

held concurrently with the Congress. It is now clear that the Crystal Palace, with its extensive grounds, will be none too large for all the requirements of the Congress.

With the valuable help of the various Committees, the organizers have lost no time in settling the basis of the Congress. Rules for exhibitors have been drawn up; large scale plans, showing the various grades of commercial sites available, have been prepared; and definite arrangements have been come to in regard to such matters as the erection and lighting of stands. Although no special steps have been taken to broadcast the unique opportunity offered by the Congress to poultry breeders and trade interests, both classes of exhibitors are already coming forward with applications for space.

The international response has been equally gratifying, and it is now certain that a very large number of nations, from Nicaragua to Norway, from Portugal to Peru, will be represented at the Congress. Organizing Committees are actively at work in Canada and the United States preparing for very powerful representation. Both of these countries have already made definite application for considerable space, and their national exhibits are certain to be highly attractive features. The matter of space for national exhibits

is, in fact, causing some concern in view of the heavy demands which are likely to be made. For example, Holland is anxious to have a large space, and its national committee is hard at work preparing an exhibit ; France has set up a strong national committee at the instance of the French Minister of Agriculture ; in Germany a national committee is at work under the Chairmanship of Professor Dr. Schatzebel ; Belgium and Denmark have also set up national Committees, and the latter country has placed its Committee under the Chairmanship of State-Counsellor W. A. Kock.

The British Empire will be well represented. Canada has been referred to above ; the Irish Free State is actively moving to secure effective representation and the staging of an imposing national exhibit ; South Africa intends to take part ; other Dominions and Colonies will doubtless be coming in. There will be a very attractive symbolic display of poultry-keeping within the Empire staged by the Empire Marketing Board.

The national exhibit for Great Britain and Northern Ireland will be one of the features of the Congress. The task of the Committee which is responsible for staging this exhibit is by no means an easy one. Substantially it is to present in a popular form a tangible demonstration of the development of the home poultry industry, with special reference to the influence of the national schemes of education and research in Great Britain and Northern Ireland. In addition, marketing displays will be staged as an integral part of this national exhibit. Voluntary organizations, which by educational means have done much to further poultry development at home, will have an opportunity of showing what they have accomplished and in what direction their future efforts will lie. The national exhibit, it may be said, will be planned under the guidance of the Department of Overseas Trade, who have had a wide experience in this class of work. It need hardly be said that the expense of staging such a demonstration, if it is to compare favourably with exhibits displayed by other countries, will be very heavy. The bulk of the expense must fall on the general Congress funds, but it is hoped that some assistance may be forthcoming from Local Authorities for Agricultural Education, who have played so great a part in educational work in poultry husbandry.

The Congress organizers are especially pleased with the enthusiasm shown by ancillary small livestock industries,

such as rabbits and pigeons, which are obviously keenly alive to the great opportunity which the Congress will afford of strengthening and developing their organization. This applies also, and perhaps in a special degree, to the small poultry-keepers (including the "backyard" and suburban poultry-keepers) who are most anxious to see the extension of a "hobby" which has proved so profitable to themselves and so valuable from a national standpoint.

An official tour is to be made after the Congress, and it will shortly be possible to publish particulars of the itinerary and the cost. The tour will provide an opportunity of seeing at small cost not only the chief features of the poultry industry of the United Kingdom but a great many of the historical and beauty spots of the country.

Anyone who wishes to learn more about the Congress should apply to the Secretary, World's Poultry Congress, 10, Whitehall Place, London, S.W. 1, for a free copy of the attractive illustrated brochure which was issued recently. Prospective exhibitors are urged to lodge their applications for space without delay or they may fail to be included in the biggest poultry Exhibition this country has ever known.

* * * * *

THE series of marketing demonstrations at Agricultural Shows on the Ministry's summer programme commenced with the Oxfordshire Show at Banbury on

Marketing Demonstrations at Agricultural Shows May 14-15, when a pig marketing demonstration was staged. At the Bath and West Show at Swindon, from May 22-25, the Ministry's demonstration covered pigs, cattle, poultry, cereals, potatoes, fruit and the National Mark, all these sections, with the exception of cattle, appearing again at the Royal Counties Show held at Southampton from May 29-June 1. The cereals and potatoes sections were shown at the Cambridgeshire Show at Ely (June 4), the Suffolk Show at Bungay (June 6-7), and the Essex Show at Witham (June 12-13); the fruit section at the Three Counties Show at Gloucester (June 4-6); pigs and pig products at the Staffordshire Show (Stafford, June 12-13); and cattle at the Leicestershire Show (Leicester, June 14-15). Pigs, cereals, potatoes and the National Mark were shown at the Royal Norfolk Show at King's Lynn (June 19-20), and again, with the addition of cattle, poultry and fruit, at the Lincolnshire Show at Sleaford (June 26-28). It will be noticed that at the Bath and West Show two sections, cereals and the National Mark, made

their first appearance. A brief description of them may be of interest.

Cereals.—The demonstration illustrates the course of market supplies and prices for home and imported wheat, barley and oats ; points in regard to thrashing, storage and transport ; the bad results of sowing poor quality seed and the advantages to be gained both in yield and quality by sowing good, tested, pure-line seed ; the excessive number of named and non-descript varieties and the variations in quality of English grain ; the necessity for a sample to be properly representative of the bulk ; the competition of standardized and graded products from abroad and the official classification and grading of grain in other countries ; the various methods of defining and attaining standards including, particularly, the standardization of production types and the method of making up fair average quality (F.A.Q.) standards ; possible standards for home-grown grain ; and the necessity for uniformity in the quality of both primary and secondary manufactured products, and the desirability of having definite standards for primary products (e.g., flour, etc.) as well as for grain.

The National Mark.—This exhibit demonstrates the National Mark as an accomplished fact. Separate stands illustrate the successful application of the Mark to (a) Apples and Pears ; (b) Eggs ; (c) Broccoli for export ; (d) Tomatoes and Cucumbers ; and there is also an inquiry bureau for those who desire further information about the National Mark.

The following demonstrations are being given during July :—

Peterborough R.A.S.E.	Peterborough Harrogate	July 2-4 July 9-13	Cereals, potatoes. Pigs, poultry, cattle, cereals, fruit, potatoes, the National Mark.
Kent Highland	Folkestone Alloa	July 18-20 July 23-26	Fruit. Pigs.
Royal Lancashire	Blackburn	July 31-Aug. 3	Pigs.

* * * * *

IN continuance of the arrangements for extending the broadcasting of market prices to farmers, concerning which particulars were given in the April, 1929,

Broadcasting of Market Prices for Farmers

issue of the JOURNAL, it has been arranged that a bulletin of market prices shall be issued for the Newcastle area in substitution for the general information formerly broadcast from London. This local bulletin is given on Thursday evenings at 6:30 p.m., and the first broadcast under this arrangement took place on May 16.

THE MECHANICAL IMPROVEMENT OF GRASSLAND

G. H. BATES, B.Sc.,

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DURING the last two or three years, a number of experiments and observations on the improvement of grassland, by mechanical means alone, have been carried out at Hardwick Park in N.E. Derbyshire, in collaboration with Captain J. D. Penrose. The Park is the property of the Duke of Devonshire and comprises 500 acres overlying the Permian formation. The herbage, which was badly matted, consisted chiefly of bent (*Agrostis alba*), Yorkshire fog (*Holcus lanatus*), tussock grass (*Aira caespitosa*) and mat grass (*Nardus stricta*).

The experiments have recently been extended to other centres, where the methods have been tested on pasture and meadow land, and in conjunction with the application of fertilizers or dung.

The following notes are a record of changes of method which have resulted from experimental experience, and theories which have arisen from the observation of results.

Removal of the Mat.—The first attempt was made during the winter of 1926-27 on an enclosure of about 20 acres. Heavy drag harrows with a straight tine were used. These were drawn by a Fordson tractor and weighted with paving stones to prevent bouncing. The mat was completely dragged out, collected in heaps and carted off. The ground was levelled and consolidated by rolling.

The improvements noted in the first season were as follows : The complete disappearance of the mat, and consequently of the wet spongy conditions due to the retention of water at the surface. While the surface became dry, the underlying soil was moist, owing to the percolation of water—previously retained by the mat. In a matted pasture, the underlying soil is always dry, though the surface may be saturated.

The rapid recovery of the herbage was marked by the appearance of large patches of wild white clover and by the rapid diminution of sorrel and the coarser grasses. The stock-carrying capacity improved in the first season, and cattle showed a marked preference for the plot. There are signs that this practice would need to be repeated about every four years.

Decomposition of the Mat.—The collection and removal of the matted material involved a heavy expenditure of labour,

and it was found that decay took place when it was left on the surface and occasionally stirred with the chain harrow. This led to further investigation into the nature of the mat and the best method for its destruction.

An examination of the mat showed it to consist almost entirely of root fibres with a small amount of moss at the surface. The consistency ranged from a light fibrous material at the top, to a peaty substance at the bottom. The burning effect of lime was tested at one centre, but except where an enormous dressing of quicklime was applied there was no result. Lime may be prevented from reaching the soil by the density of the mat. This was instanced at Hardwick Park, where a certain area received a dressing of ground lime at the rate of 30 cwt. per acre. Three years later this was found $\frac{1}{2}$ -in. below the surface, embedded in a 3-in. mat.

Dressings of cyanamide of lime (*calcium cyanamide*) at the rate of $2\frac{1}{2}$ cwt. per acre, at another centre, failed to have any appreciable effect beyond scorching the surface, though there is reason to believe that this fertilizer may hasten decomposition once the mat has been disturbed. It was shown by experiment that mat may be decomposed by mechanical means in two ways: (1) by tearing it out and exposing it on the surface to oxidation, or (2), as will be more fully discussed later, by cutting it up and mixing it with the soil.

Severe Mechanical Treatment.—Although the change in the herbage as a result of treatment with the drag harrows was a very striking one, it was not so remarkable as the contrast between the herbage on a coarse matted pasture and that on the footpaths which traverse it. It is a remarkable fact that, however bad a pasture may be, one never fails to find clover and good quality grass on the footpath or part which has been constantly trampled.

Remarkable changes were noted, during a recent strike, as the result of grazing a large number of pit ponies on a small enclosure during wet weather. In a lower degree, the same phenomenon has been observed after heavy stocking with cattle and pigs. This is not consequent upon the tearing out of the mat or stirring of the surface soil, but the mat is cut up and literally punched into the soil. Many ascribe the growth of clover on a footpath to aeration of the soil, but this is difficult to understand, as the reverse really takes place, the soil being consolidated at the surface.

An operation, aiming at the imitation of the action of the hoof, was carried out on about four acres of very matted

pasture. While the ground was wet, it was heavily disc harrowed, until the mat was cut to pieces and mixed with the soil. It was then heavily rolled. The land presented the appearance of a ploughed field and several farmers gave it as their opinion that it was "ruined for ever." The operation was carried out in March and the result during the first summer was remarkable. The mat disappeared in a very short time, apparently decomposing in the soil, and a carpet of white clover covered the surface. A more unexpected result was seen where a small area was enclosed for mowing. In place of the former grasses this enclosure yielded an excellent crop of perennial rye-grass and white clover. It was difficult to convince many visitors that a renovation mixture had not been sown. The following analysis of pasturage, by Mr. A. Roebuck, is given in connexion with this experiment.

HARDWICK PARK. EXPERIMENT IN SEVERE MECHANICAL TREATMENT
BY DISC HARROWING.

*Analysis of Pasturage by Mr. A. Roebuck, Midland Dairy and
Agricultural College.*

Untreated Portion :—

	Per cent.
Agrostis	35.4
Crested Dogtail	24.6
Sheeps' Fescue	23.1
Wood Rush	9.2

Miscellaneous

Perennial Rye-grass	}	7.7
Wild White Clover		
Buttercups		
Moss ..		
Yorkshire Fog		

100.0

Treated Portion (very severely disc harrowed) :—

	Per cent.
Smooth-stalked Meadow Grass	50.9
Crested Dogtail	21.7
Agrostis	9.1
Wild White Clover	12.0
Perennial Rye-grass	1.0

Miscellaneous

Yorkshire Fog	}	5.3
Sheeps' Fescue		
Buttercup		

100.0

Root Structure and Habit.—The above result was unlooked for and resulted in some investigation being made for a possible explanation. The only apparent solution, in the

writer's opinion, lies in the root habit of the plants concerned. The original coarse grasses were all surface rooters forming a mat of fibrous material; on the other hand, rye-grass and clover have roots of the opposite type. Rye-grass possesses roots which are comparatively thick, and penetrate directly downward in a characteristic manner, and all members of the clover family have strong tap roots which penetrate from $\frac{1}{2}$ to 3 in. before they branch at all. Both plants are deep rooted. Either the mechanical treatment allowed the percolation of water previously prevented by the mat and thus favoured the deep rooting plants, or the consolidation of the surface layer of soil made conditions unfavourable for surface rooters; but they were surmounted by the strong deep-rooted plants which found a free field for development. This latter theory would explain the growth of clover on a foot-path.

The Best Implement.—A trial of different types of rejuvenators and mechanical devices was carried out at Hardwick Park during November of last year. The result will not, of course, be apparent for a year or two. Observations on different methods of mechanical improvement seem to demonstrate that the most effective implement should be directed towards cutting the mat, mixing it with the soil and consolidating, rather than tearing material out. An interesting device has been constructed by Messrs. G. C. Ogle & Sons, of Ripley, Derbyshire (provisionally patented), which consists of a roller with narrow rings. Between the rings sharp discs protrude, which cut the mat into squares and mix it with the soil, the whole being consolidated. The discs are eccentric to the axle of the roller and may be withdrawn by a lever. The implement may then be used as an ordinary roller.

Improvement of Meadows.—Experiments were carried out at three centres in North-East Derbyshire, *i.e.*, Ashgate, Gleadless and Tapton, on the effect of mechanical treatment on meadow land. In each case the disc harrow and roller were used and a portion of the field was left untreated. The increased yield of the treated portion over the untreated ranged from 25 to 50 per cent. with a more succulent herbage of higher quality.

When the mechanical treatment was followed by a dressing of dung over the whole of the field, the treated portion was of a much deeper green than the untreated, giving the appearance of having received a nitrogenous top dressing; the demarcation coincided exactly with the boundary of the two

portions. This phenomenon was explained by the fact that, on the treated portion, the dung came into direct contact with the soil, whereas on the untreated portion it remained on the surface of the mat to be scorched by the sun.

Improvement of Close Cutting.—The effect of frequent mowing or severe grazing for two or three years, in stimulating a growth of wild white clover and giving a succulent, protein-rich herbage, has led to this treatment being regarded as a means to the improvement of pasture. The phenomenon was probably first observed where it was desired to produce a putting green or cricket pitch from a rough pasture, without the expense of turfing or sowing a lawn seed mixture. A patch of level ground is chosen and by constant mowing the desired effect is produced. The original herbage becomes invaded by patches of wild white clover, and the grass presents a fresh green appearance. Possibly the idea that constant mowing or severe grazing is a means to pasture improvement has not been given a lengthy enough test. It is a difficult thing to reconcile this theory with the elementary fact that the constant cutting of foliage will eventually kill a plant by depriving it of its organ for the synthesis of carbohydrate. Recent work at Aberystwyth has shown that frequent cutting weakens the root system; and, in a grazing trial with sheep, both the animal and the pasture fared best when a long resting period was allowed.

Excellent opportunity was offered at Hardwick Park for observing the effect of close mowing over a period of years. A cricket pitch formed by mowing the original turf, which consisted of the coarse herbage originally described, has been in existence for twenty years. The plant population is now composed as follows:—a very small-leaved white clover, annual meadow grass, plantain, daisy, hawk weed and a large proportion of heath bedstraw. The weeds in this group are common on many lawns. It is obvious that the only plants which can survive this treatment are those which possess flat leaves or are closely pressed to the ground, thus escaping the cutting.

It would appear that severe grazing without a long resting period for the growth and functioning of the leaves will eventually produce a useless herbage, and it is difficult to see that the application of fertilizers in any form can make up for the inability to produce carbohydrates. It is necessary, however, not to confuse severe grazing with systematic grazing and the removal of uneaten coarse grass.

THE SOILS OF LANCASHIRE & CHESHIRE : A PRELIMINARY STUDY

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Geography.—Perhaps the predominant physical feature of Lancashire and Cheshire is the large area of low-lying country between the Irish Sea and the Pennine Uplands. The plain is restricted to a narrow coastal strip in the north by the Bowland Fells, whilst, between the Ribble and the Mersey, a large spur of the main Pennine ridge, termed the Rossendale Fells, extends westward to form an important upland. From the Rossendale Fells in the north to the lower hills of south Shropshire, and bounded east and west by the Pennines and the Uplands of North Wales, respectively, stretches the gently rolling country called the Cheshire Plain. In certain places in south-west Lancashire and across the Mersey basin the plain is very level, but there are many minor elevations and several escarpments rising to about 600 feet above sea level. Mention may be made of the Peckforton ridge, Alderley Edge, and Congleton Edge, which contribute not a little to the interesting landscape. Throughout the province, however, the Pennines rise abruptly to form the eastern wall of what is essentially a geographical unit, for the two divisions of upland and lowland bear to each other a relationship that has probably become more and more marked with that great industrialization which has made the region in many respects the most notable in the country. All the main rivers, with the exception of the Dee, have their sources on the western flanks of the Pennines and flow to the Irish Sea, and while the Mersey Basin is the largest, the Ribble drains an area of about 600, and the Weaver and Mersey estuary about 700 square miles.

The climate of the province is directly influenced by its position on the western seaboard, and is characterized by an average to high rainfall, well distributed throughout the year, and a low seasonal range of temperature. Generally speaking, the rainfall varies from about 28 inches to 32 inches on the coast and low-lying country, but increases rapidly with elevation to between 40 inches and 60 inches at 800 feet to 1,000 feet above sea level. Variations in relief, are, of course, responsible for comparatively large local fluctuations, and that is especially the case for places on the flanks of the uplands. For example, while the average rainfall is 31 inches at Denton

at an elevation of 324 feet, that at Swineshaw, 6 miles distant and 560 feet higher, is about 45 inches, and it is quite probable that even more abrupt changes occur in many parts where the local configuration suggests large differences. There are similar variations in mean temperature, but the average (reduced to sea level) is about 40° F. in winter and about 60° F. in summer.

Classification of Soils.—The Pennines and the hills of North Wales consist of Carboniferous rocks, and Limestone, Millstone Grit and Coal Measures are all represented. The region, nevertheless, appears to have undergone glaciation to an altitude of over 1,000 feet, and the ice, on its retreat, left a thick deposit of boulder clay containing variable amounts of sand and gravel. Where that drift is thin, on the hillsides, it may consist largely of local material; but on the lowlands it may be as much as 200 feet thick and bear little or no relationship to the underlying rock. A great deal of glacial material has been re-sorted by water to give stratified deposits of clay and sand without any regularity; and in addition, there are areas covered by river alluvia and peat.

Apart, therefore, from the upland moorlands and certain limited areas of minor elevation, the soils of the region are derived from those superficial deposits, and present a great variety of characteristics on account of the wide variation in the properties of those deposits. It will be convenient to treat the area in sections which are devoted to certain types of agriculture, at times probably as a result of the soil type, but at times also in spite of the soil type. The simplest division is as follows: (1) Permanent grass land occupying the slopes of the Pennine Uplands up to an elevation of about 1,000 feet; (2) the general farming areas of the plain covered by glacial and post-glacial deposits; (3) the intensively cultivated peats, which may be subdivided into (a) deep peat, and (b) shallow peat usually much modified by admixture of sand. Although those divisions are convenient as a preliminary classification, it is not to be supposed that there are only three or four soil types confined to those wide areas. There is a particularly wide variation in soil characteristics, especially in group (2), where the texture may vary from that of a clay to that of a coarse sand.

Since the moisture relationships of a soil are all-important in the question of plant growth, it is necessary to consider not merely the surface layer but a depth consistent with root

penetration or water table ; frequently, although not invariably, that coincides with the thickness of weathered material, that is, material which has undergone physical, chemical and biological changes. It is often convenient to make use of the terms "soil" and "subsoil," but it is not possible to delimit the thickness of the latter, since it may exist to variable depths over the unweathered material beneath. The few brief descriptions, given in the following pages, of typical soil profiles found in this part of the country will help to make these points clear.

Peat.—Since the soils of the reclaimed mossland areas are by far the most uniform, they will be considered first. The sequence of layers through the peat is quite straightforward, and is repeated over considerable areas. Where the peat is deep, there is usually a layer of about 7 or 8 inches of black, decomposed material overlying brown, partially decomposed vegetable matter which may be as much as 30 feet thick. Sometimes there is present a certain amount of clay which makes the surface soil sticky when wet. That is the result of the extensive "marling" which was practised when the peat bogs were first reclaimed. Trafford Moss was drained in 1793, while the reclamation of Chat Moss was commenced in 1805. Sometimes the surface has been greatly modified by the heavy application of city refuse—a practice which is still carried out on Chat Moss—but that probably tends to make the texture more open on account of the presence of a big proportion of cinders and gravel, and such a soil can be worked under almost any condition. The apparent specific gravity of those peat soils lies between .5 and .6, and the loss on ignition may vary from 20 to 60 per cent. It is customary to turn up an inch or two of the raw humus when the land is ploughed for potatoes, and this gradually decomposes on exposure to air. For that reason, and also as a result of continued drainage, the level of the cultivated mossland is gradually falling and, indeed, has probably fallen several feet in living memory. A three or four years' rotation is adopted, potatoes—usually maincrop varieties on account of the late spring frosts prevalent on this kind of ground—being followed by oats and grass and occasionally wheat. In some areas, market garden crops are grown almost exclusively.

Although liming is carried out regularly in certain parts, the soils so treated usually remain fairly acid on account of their high absorptive capacity for bases. Figures indicating

high "lime requirements" must, therefore, be regarded with great care, for the "intensity of acidity," as distinct from the "quantity of reserve acidity," may not be adverse to the particular crops that are grown.* Although between 50 and 60 per cent. of those soils examined have a "lime requirement" varying from 4 tons to as much as 10 or 12 tons per acre of calcium carbonate, over 60 per cent. have a pH value greater than 5.5, a figure which is probably quite suitable for the crops grown. It is obvious, therefore, that whilst "L.R." may indicate how much lime the soil could absorb, it does not show how much the soil requires to ensure satisfactory plant growth. Those peat soils usually possess a large amount of exchangeable calcium (figures varying from .7 to 1.3 per cent. have been obtained), which may be taken to mean a good reserve of calcium readily available for plant nutrition. The vegetable matter contains a good reserve of nitrogen, which becomes available if the lime status is satisfactory, but such soils are notoriously short of potash and phosphate.

Peaty Sands.—Where the layer of peat is thin and, as is generally the case, overlies sand, the latter has usually been incorporated to a greater or less extent with the former, giving rise to what is really a peaty sand. This type of soil is very common, particularly in west Lancashire, and may contain about 70 to 80 per cent. of sand and about 10 per cent. of organic matter. Sometimes the substratum of sand is thick, in which case the soil is liable to suffer severely in periods of drought, but occasionally it is quite thin and rests on clay or a clayey material which can hold up the water. Usually the sand is almost white in colour to a depth of about 18 inches, where a hard layer of red cemented sand from 1 to 6 inches thick is found. This hard layer, known in Cheshire as "Foxbench," is not a plough-pan but a result of soil-forming processes. The two following descriptions are typical of such soils:—

At Gawsworth, near Macclesfield, on the margin of a peat hollow, there occurs a greyish-black peaty sand, changing abruptly at 7 or 8 inches into a white sand overlying at 15 inches a hard-cemented, red to coffee-brown and black layer 6 inches thick.

* Degrees of acidity are expressed by means of a scale, the numbers on which are termed pH values. The number 7 expresses neutrality, and the smaller the number the greater the degree or "intensity of acidity."

"Lime-requirement" figures (L.R.) indicate roughly the amount of calcium carbonate necessary to bring the soil to a state approaching neutrality, *i.e.*, to neutralize the "reserve acidity."

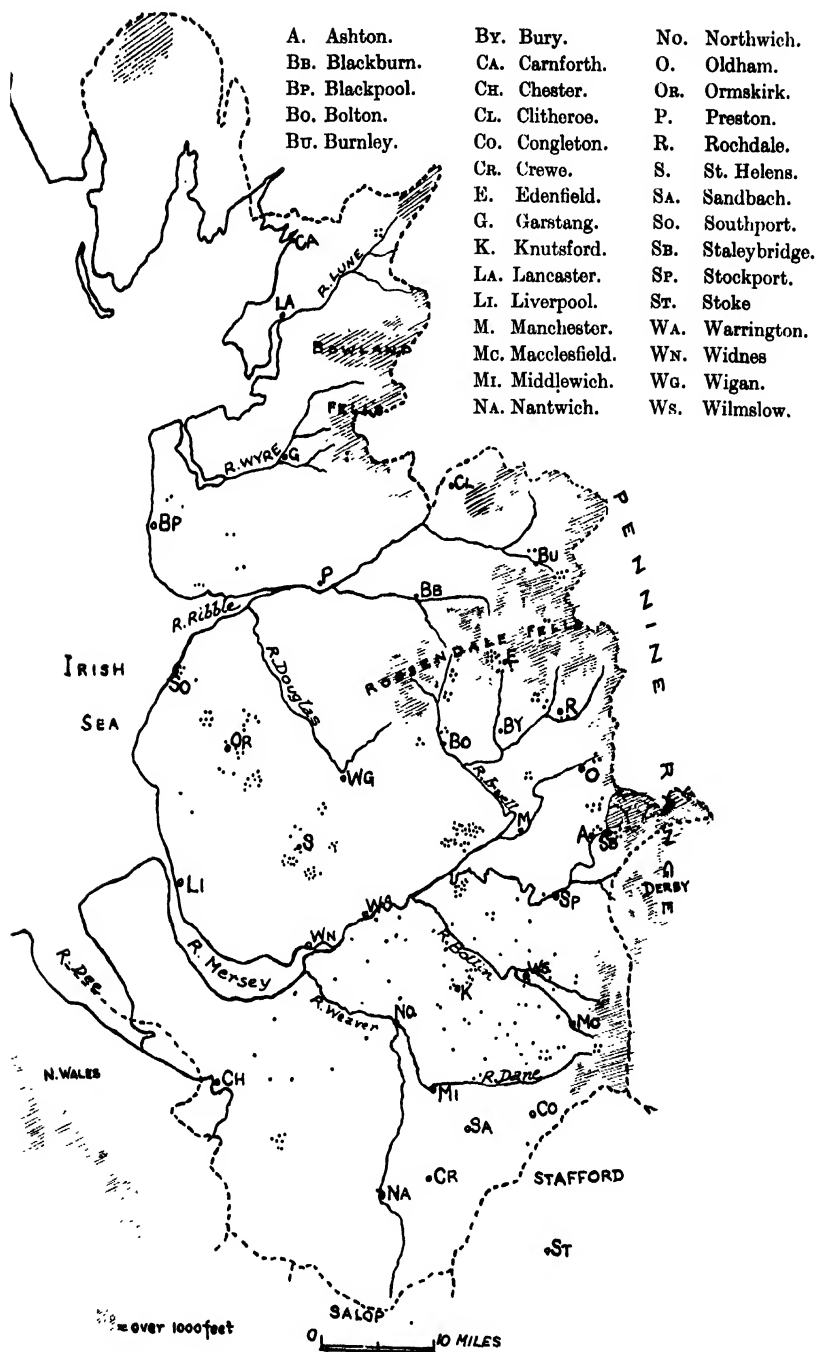
which in turn rests upon loose yellowish-brown sand. The "Foxbench" in this case contains 4.5 per cent. of organic matter, which would appear to be largely responsible for the cementation, because the ignited material is almost white and identical in appearance with the white sand layer immediately above.

The same is true in the case of a sample taken near Ormskirk. In this case, 9 inches of peaty sand overlies about 6 inches of yellowish-grey sand resting on a hard, coffee-brown cemented sand 3 inches thick, whilst at 2 feet there is a sandy clay very mixed in colouring.

Where the cemented layer is fairly thick it probably helps to conserve the moisture, but such soils are usually regarded as dry and "hungry," and require heavy dressings of farmyard manure. It would be interesting to see green manuring attempted, but it would probably necessitate an earlier lifting of the potatoes than is customary. Potatoes and oats, followed by one-year grass and occasionally wheat, is the rotation usually practised on this type of land.

Permanent Grass Land.—The majority of the soils examined, belonging to this group, have been from the arc formed by the southern slopes of the Rossendale Fells and the western slopes of the main Pennine ridge. The points on the accompanying sketch map will be found to lie mainly between the industrial towns and ground 1,000 feet above sea level. The permanent grass land farms, in fact, occupy the rising ground between the plain and the upland moors, their markets being the towns situated in the valleys and on the foothills. Generally speaking, both the pastures and meadows are poor, and the reasons are not far to seek. A typical meadow soil consists of a greyish-black, sticky loam changing abruptly at about 3 inches to a granular, multi-coloured sandy clay; at 6 inches below the surface, mixed greys and rust colours predominate, then the texture may become more open or more compact, since the drift material varies rapidly from a sandy clay to a sticky sand. Heavy applications of farmyard manure are made annually, and the loss on ignition of the surface 6 inches of such soils may be as much as 24 per cent.

A typical pasture soil consists of a mat of partially decomposed vegetable matter 1 to 2 inches thick overlying about $\frac{1}{2}$ inch of black, decomposed matter, passing into a grey layer about 1 inch thick, with a substratum of light greyish-brown, speckled sandy clay or sticky sand. The chief features are the sudden change from the organic surface layer to the grey horizon followed by the gradual transition in colour and structure to the parent material.



THE SOILS OF LANCASHIRE AND CHESHIRE: A PRELIMINARY STUDY.

An examination of nearly 100 of those permanent grass land soils has shown that, in almost half of them, the biological activity must be practically negligible on account of the extreme acidity. The result is that the organic matter forming the surface mat is accumulating rather than decomposing, and in many cases has formed a dense layer practically waterproof except after continuous heavy rains. It may absorb more than its own weight of water, and it is not unusual to find the mineral soil, immediately below, quite dry after a heavy precipitation. Consequently, only those plants thrive whose roots can ramify through the surface. The acidity diminishes with depth, but it is obvious that the nature of the surface itself is bound to inhibit the growth of desirable species. It stands to reason, therefore, that the intense acidity must be at least partially corrected, and the mat severely disturbed to promote aeration and allow free percolation of water, before improvement of the herbage can be expected and the application of artificial fertilizers become profitable. The "lime requirement" figures for those soils may be very high (as great as 1 per cent. CaCO_3) on account of the high absorptive capacity due to organic matter, and over 50 per cent. indicate more than 3 tons per acre of calcium carbonate. Those figures are, of course, calculated for 8 or 9 inches of soil, and must, therefore, be considerably modified for the matter in question, but, in view of the intensity of acidity, it is evident that half of those soils require immediate liming. In certain cases of poor pasture, excellent results have been obtained by renovation with lime or basic slag, accompanied in each case by mechanical treatment.

General.—The remaining group comes under the heading of glacial drift and recent river alluvia. No attempt has been made in this preliminary classification to separate areas of heavy and light soils, for the simple reason that the changes are frequent and rapid. Generally speaking, the soils have a warm reddish to reddish-brown colour, depending upon the amount of organic matter present and the nature of the subsoil. As the previous description of the drift would indicate, their texture is extremely variable, not only on the surface, but to considerable depths. A sandy loam, for example, was found to overlies pure yellow sand in one place and a chocolate coloured clay in another place in the same field, and it is not uncommon to make a series of eight or ten borings in the course of a traverse of a few miles without finding any one

duplicated with regard to nature and sequence of strata. Sometimes a sticky grey and orange sand or a brown clay is met between two sandy layers; sometimes the texture is open and uniform to 2 or 3 feet; sometimes gravel or coarse sand occurs close to the surface, and is confined to a few inches or goes down to a depth of several feet. It was not found possible to subdivide the soils of this group into satisfactory classes, so that they represent a series ranging from sands and sandy loams to heavy loams and clays.

The agriculture is mixed, being general arable in some districts and largely dairying in others, particularly in that region south-west of the Weaver. The soils examined were sampled chiefly in north-east Cheshire and in parts of south-west Lancashire which are free from peat. Generally speaking, the distribution of the acidity figures for this series is similar to that for the peaty sands. It is impossible to generalize on such a heterogeneous group, but from a study of the figures it would appear that between 30 and 40 per cent. of those soils require lime.

Conclusions.—A great deal of weight has been placed on the question of soil acidity in the foregoing pages, and it might be convenient to summarize the position. There is no doubt that comparatively little lime has been employed in agriculture in recent times, whereas it was used to a great extent last century. It is interesting to quote a passage written in 1843 by the great German chemist, Liebig :—

“In the month of October, the fields of Yorkshire and Oxfordshire look as if they were covered with snow. Whole square miles are seen whitened over with quicklime, which, during the moist winter months, exercises its beneficial influence upon the stiff, clayey soil of those counties.”

It is not unlikely that such a practice was followed in other places, for in writings of 1830 there is mention of the “inexhaustible supply of limestone at Clitheroe, much sought after for manure,” and the working of many kilns. It is quite common to-day to find, in permanent grass land soils, lumps of lime at fairly uniform depths below the surface. The material must have been applied in a very roughly ground condition, and has gradually reached a depth of 2 or 3 inches below the surface, partly by gravity and partly by being covered. At the present time these lumps are not fulfilling a useful function except in their immediate neighbourhood.

There are many records of the “marling” which was practised during the first half of last century, particularly in

the reclamation of mossland and extremely light sandy soils. Old maps of certain areas show marl pits in every field and, although they are now usually filled up or covered over by vegetation, they are frequently a source of annoyance in arable parts, albeit a useful drinking place for stock. The term "marl" is employed very loosely, and in this area may refer to heavy boulder clay or Keuper Marl without consideration of calcium carbonate content. An examination of a number of samples taken from depths ranging between 3 and 10 feet showed that the amount of calcium carbonate might vary from a trace to 8 per cent. In the course of the last 50 or 100 years the "marl" applied has become distributed through the surface soil and, in light soils, been carried below the surface layer, so that many of those light soils have become exhausted and probably fit only for heath association and certain conifers. As a method of ameliorating soil sourness, "marling" at the present time is no doubt out of the question, but as a means of restoring "body" to light soils in areas of intensive cultivation, it might be worthy of serious consideration. Similarly, although the reclamation of more mossland would at first sight appear to be uneconomic, it is not inconceivable that, owing to the rapid extension of industry, and modern mechanical methods of cultivation, the matter may soon merit attention.

It is important to bear in mind how much this ever-increasing intensive farming is the result of the economic situation arising from the great industrialization of the region. The origin of the cotton industry was singularly fortunate in the natural resources. The water supply, coming from the Grit Highlands, was "soft" and ideal for bleaching and printing purposes, and abundant and regular in flow for power. The easy winning of coal from hillside workings was another important factor in the rate of progress. The salt workings of mid-Cheshire then gave rise to the innumerable products which have resulted in Merseyside becoming a focus of heavy chemical industry. Compounds of chlorine for the bleaching materials demanded by the textile industry, caustic alkali for the soap industry at Port Sunlight and Warrington, tannery requisites for Widnes and Runcorn, and the various chemicals required by the glass manufacturers at St. Helens, are all dependent upon the salt field for their parent material. The intensive cultivation of small holdings for the production of vegetables for the neighbouring towns has thus become possible, and the essentially rural areas have benefited by the

not too distant markets. While industry has stimulated agriculture, however, it has exacted heavy penalties. Most of the industrial towns cluster round the foothills and on the rivers, so that the adjoining grass land areas are of tremendous importance and the dairy industry has developed rapidly. Nevertheless, this urban agriculture has a pathetic side, for, as has been said of south-east Lancashire, the farmers "literally wring a livelihood out of the begrimed pastures which scarcely separate the towns."

It is not possible to say how far the soot and acid fumes are responsible for the sourness of the soils. That the vegetation suffers severely in certain localities for no other apparent reason is undoubtedly the case, and it is quite probable that the polluted atmosphere extends a considerable distance from the origin of the smoke. It would, therefore, appear to be legitimate to assume that the loss of calcium from the soils in the neighbourhood of the industrial areas is much greater than normal, and that liming requires more attention than in rural parts. The fact which certainly emerges from a careful study of the district is that about half of the soils in the centre of the province require immediate attention, whilst many of the remainder will probably require lime in the near future.

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FINANCIAL RESULTS FROM A HERTFORDSHIRE SMALL HOLDING

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SINCE October, 1924, the occupier of a small holding under the Hertfordshire County Council has co-operated with the Herts Institute in the keeping of cost accounts; and, from the data now available, it is possible to review briefly the results obtained. It should be noted that the financial records relate to the period October 1 to September 30 in each case, *e.g.*, the accounts 1927-28 refer to crops grown in 1928.

General Description of the Holding.—The holding extends to 54 acres and is situated in the north-east of the county on the outskirts of a small country town. It is one of a group of holdings established by the County Council in 1920.

The land is a medium loam lying on chalk and is comparatively easily worked. It was not in a high state of cultivation when the present occupier took over in 1922. The

entire buildings were provided by the County Council. These comprise a brick dwelling house of six rooms, and a farmstead of brick and wood construction. There is a two-stalled stable, a cowshed for three cows, a small barn, an open yard with shelter, and a lean-to cart shed. The tenant has added a range of pig houses and several poultry houses.

Before he entered the holding, the tenant had no practical experience other than that gained by a year's course at the Hertfordshire Institute of Agriculture. He served in the Army from 1914 to 1921 and previously had been engaged in clerical work.

CROPPING SCHEME.—The cropping (in acres) for the four years is set out in the following table :—

<i>Crops</i>	1925	1926	1927	1928
Grass Land	9	9	9	9
Wheat	10	8	4	6
Barley	5	6	12	14½
Oats	5	5	6	4
Hay	6	4	2	5
Lucerne	3	1½	1½	½
Brussels sprouts	6	13	8	10
Sugar Beet	1	4½	4½	—
Potatoes	5	2	6	4
Vegetables	4*	1	1	1
	54	54	54	54

* This includes three acres of roots. In succeeding years only a very small acreage of roots has been grown, principally on headlands.

The table indicates that the cropping is as diverse as on a large farm, and that the only special crop grown is Brussels sprouts. The soil is very suitable for the cultivation of this crop, for which there is usually a good demand in London. A few cabbages, lettuce, and other vegetables are grown ; and in the garden some fruit trees are now beginning to come into bearing.

On the average of the four years, 16½ per cent. of the area is grass land, 40 per cent. is devoted to cereals, 8 per cent. to potatoes, 11 per cent. to hay, 18 per cent. to Brussels sprouts, and 6½ per cent. to sugar beet, roots, cabbages, vegetables, etc. Cows, pigs, and poultry are kept.

FINANCIAL RESULTS

The scope of the present article makes it impossible to do more than briefly outline the general results that have been achieved, and the table on the opposite page summarizes the income and expenditure in each year.

TRADING ACCOUNTS FOR EACH YEAR

	<i>Expenditure</i>				<i>Income</i>			
	1924-25 £	1925-26 £	1926-27 £	1927-28 £	1924-25 £	1925-26 £	1926-27 £	1927-28 £
To Sundry payments, viz—					By Sundry Receipts, viz.—			
Rent and rates ..	99	102	96	95	Barley ..	—	82	206
Manual labour ..	256	309	336	344	Wheat ..	—	47	—
Seeds ..	14	44	38	47	Oats ..	19	18	—
Manures including					Potatoes ..	49	70	189
London dung ..	55	85	50	47	Sugar beet ..	—	80	90
Purchased foods ..	216	213	236	288	Brussels sprouts ..	190	160	414
Live Stock : Cows ..	40	—	6	—	Cows : Stock ..	39	67	32
Pigs ..	3	14	6	—	Milk ..	146	136	124
Poultry ..	3	6	4	6	Pigs ..	226	288	270
Repairs to implements	4	4	10	16	Poultry ..	100	158	162
Shoeing ..	4	5	5	3	Bees ..	6	3	16
Other expenses ..	18	40	75	59	Other income ..	56	37	42
Total expenditure ..	712	822	862	905	Total Income ..	831	1,146	1,545
Valuation at beginning of year ..	772	830	1,081	1,059	Valuation at end of year	830	1,059	829
Net profit ..	177	268	262	410	Net loss ..	—	—	—
	1,661	1,920	2,205	2,374		1,661	2,205	2,374

Review of Expenditure.—The average annual cash expenditure has been £825 or approximately £15 6s. 0d. per acre. The largest single items of expenditure are those for manual labour and purchased foods.

Manual Labour.—The work of the holding is done by the tenant, one man and a boy. The tenant's wife attends to the poultry, but a record of her time is kept and charged in the accounts. When required, as for picking Brussels sprouts and for potato lifting, casual labour is employed. Time sheets are kept for each worker, including the tenant himself. The rate of wages paid has been 31s. per week for the man and 16s. per week for the boy. The tenant's own labour has been charged in the accounts and is shown separately in the following statement of labour costs :—

Year	Gross			Per Acre			Value of tenant labour			Net		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
1924-25	256	6	0	4	15	11	92	11	4	163	14	8
1925-26	309	1	8	5	14	6	95	6	4	213	14	4
1926-27	335	12	7	6	4	3	79	9	8	256	2	11
1927-28	344	9	8	5	6	10	75	5	3	269	4	5

The labour cost is relatively high, but one would expect it so on a holding of this size and with such a high proportion of the area under crops calling for heavy labour expenditure.

Purchased Foods.—The expenditure on purchased foods has averaged £238 5s. 0d. per annum, or £4 8s. 3d. per acre. All stock are strictly rationed, and the tenant is particularly keen in selecting and purchasing foods. On many occasions he has been able to buy forward on easy prices and to secure delivery in lots as required. The variety and extent of the foods purchased may be gathered from the following list, which represents the principal purchases in 1927-28 :—

	Tons	Cwt.		Tons	Cwt.
Middlings ..	6	4	Dairy nuts ..	4	5
Maize meal ..	4	2	Pollards ..	3	18
Beet pulp ..	2	5	Rice Meal ..	1	19
Barley meal ..	0	9	Fish meal, etc.	1	12
Maize germ, etc.	1	8			

Other foods purchased have been minerals, beans, ground oats, oatmeal, and cod liver oil.

Manures.—The expenditure on manures, including London dung, has averaged £59 5s. 0d. per annum, or £1 1s. 2d. per acre. Dung forms the basis of all the manuring, and is applied to the root break—potatoes and Brussels sprouts. Artificial manures are used on the grass land, potatoes, and Brussels sprouts, and top dressings are occasionally given to cereal crops.

The other items of expenditure call for no special comment.

Review of Income.—The average annual cash income has been £1,090 or approximately £20 per acre, and the chief sources of income have been barley, Brussels sprouts, milk, pigs and poultry.

Cereals.—Most of the oats and wheat have been consumed on the holding, and a proportion of the barley has been used for feeding. It has, however, been possible to grow excellent malting samples of barley and this crop has been consistently the best cash cereal crop.

Potatoes.—Seasonal variations in yields and, more particularly, prices have caused considerable variations in the return from this crop.

Brussels sprouts.—The figures showing the income from Brussels sprouts require some explanation. The income for 1924-25 of £190 represents the sale of the crop grown in that year; the £8 income in 1925-26 is part of the 1925-26 crop, the sale of which was completed in 1926-27, and the £414 income in 1927-28 represents the sale of two crops, viz., the 1926-27 one and the 1927-28 one. The completion of the sale of the current year's crop is reflected in the lower valuation at September 30, 1928.

Live Stock.—Sales of live stock or live stock products have averaged £587 per annum or approximately 54 per cent. of the total sales.

Cows.—From three to four cows have been kept, and their calves have been reared. The milk is sold wholesale and has brought in an average income of £137 per annum.

Pigs.—Approximately six sows of very good Wessex type have been kept. Most of the pigs have been sold for pork either direct to a local butcher or by public auction, and a few have been sold for breeding purposes. The average income from pigs has been £257 10s. 0d. per annum. This sum includes about £15 which represents fees and premiums received for the services of the boar.

POULTRY.—The annual income from Poultry has averaged £143 5s. 0d. The laying stock number about 200, and most of the sales have been from eggs.

Other Income.—Included in this item are sales of fruit, vegetables, and sundries.

Profits and Losses.—The table on the following page shows how the profits and losses have been made up in each year.

PROFITS AND LOSSES.				
	1924-25	1925-26	1926-27	1927-28
	£	£	£	£
Wheat	—	-27	18	—
Barley	—	89	35	75
Oats	8	—	3	—
Sugar beet ..	—	3	- 7	4
Potatoes	-15	-34	17	35
Brussels sprouts .	47	—*	-80	68
Cows	48	4	51	17
Pigs	40	121	131	102
Poultry	25	96	87	76
Bees	5	7	3	13
Vegetables, etc. .	19	9	4	20
	177	268	262	410
	—	—	—	—
SUMMARY	£	£	£	£
Crops, etc. ..	59	40	- 10	202
Live Stock ..	118	228	272	208
	—	—	—	—
	177	268	262	410
	—	—	—	—

* See note on valuation of the crop under Review of Income.

An examination of these figures brings out the interesting fact that with the exception of 1927-28 the profits have depended almost entirely on the live stock. In no year did any branch of the live stock fail to show a profit. Barley has proved the most remunerative crop, far exceeding both potatoes and Brussels sprouts in its return. In fact, on the average there has been nothing in potatoes and comparatively little in Brussels sprouts.

Conclusion.—The figures quoted show that excellent results have been achieved on this particular holding. No information is available regarding the finances of other holdings in the county and the example here given must not be taken as an indication that all are doing well. As an indication of what may be achieved it is not without interest. Probably the secret of this smallholder's success has been his business acumen. Every purchase he makes is done after studying quotations and comparative values; many of his sales are direct to the consumer or retailer. Efficient marketing has paid him well and the success of his methods is clearly indicated in his profit and loss accounts. One further comment should be made. The tenant has made very full use of the detailed cost accounts in adjusting his cropping and expenditure, and they have been of definite value to him in a number of instances.

THE METHOD OF FIELD EXPERIMENTATION

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THE complaint is not infrequently heard that the response of farmers to the recommendations of those engaged in agricultural education is unsatisfactorily slow. The purpose of this article is to suggest that the reason for this state of affairs is due, not—as is so often implied—to the unprogressive attitude of the farmers, but rather to the method of field experimentation on which educational staffs have depended to no small extent for bringing their lessons home to the farmers.

Field Experiments.—For some time past there has been a growing sense of dissatisfaction with regard to field experiments, as used for this purpose, and attempts have been made to overcome this feeling by raising the standard of the technique by which such experiments have been conducted. The root of the trouble seems to lie deeper than this. The trouble, in fact, is due not necessarily to bad workmanship in the conducting of experiments, but to the attempt to use the experimental method at all for purposes for which it is not suitable.

Experiments are a necessary part of the equipment of the scientist engaged on fundamental research. County agricultural staffs, however, are not concerned with the solution of fundamental problems, but with problems of ordinary farm practice, and it is here suggested that the experimental method is not the best method of studying ordinary farm practice.

Farmers have never been slow to acknowledge the value of science, nor would they deny that the scientific worker may learn much from the use of experiments. On the other hand, their slowness to apply the results of experimental work to their own farms is probably evidence of their quickness to observe the truth that experiments alone are no guide to better farming.

It is one thing for the scientific investigator, who is not primarily concerned with the appeal to farmers, to use the experimental method as an aid to his own researches. It is quite another for it to be used as a demonstration to farmers of how to farm better.

It is suggested that existing methods look too much to scientific experimentation and too little to the study of actual

farm practices already being followed by farmers. For example, there are the manuring of various crops, liming, varieties of seed, quantities of seed, dates of sowing, and other problems of cultivation, as well as numerous questions of livestock management. In all of these things individual farmers have their own practices. The problem is to discover which are the better practices in each case.

The method adopted for this purpose by those engaged in agricultural education is the controlled plot, or feeding experiment. In the plot experiment the method is to take small areas of land, and by exact measurements of seeds, manures, drill-widths and so on, to discover and demonstrate if possible the better practices as measured in terms of yield of crop. In the feeding experiment the method is similar. Selected animals are fed on different rations, and the results are compared in terms of livestock increase, yield of milk, or whatever test is applied.

The conditions thus set up are purposely artificial. It is an essential characteristic of any experiment that they should be so, since an experiment which is not controlled is valueless. These artificial conditions, however, inevitably divorce the experiment from actual farming conditions. The results of such experiments must therefore be interpreted in the light of farming conditions before they can have any educational value. This interpretation is no easy matter. It is indeed often so difficult that there is every temptation for the experimentalist to leave it to the individual farmer to make his own interpretation. Words used recently with regard to the manuring of potatoes may be cited in this connexion.* "The results of similar experiments carried out at different centres are often seemingly contradictory. It is therefore necessary that individual growers should conduct some form of rough local experiment on their own farms before committing themselves to extra outlay on their potato crops." Here is the weakness of the whole process, namely, the discrepancy between devising extremely delicate experiments for the guidance of farmers, and then recommending them to conduct their own rough experiments. If farmers must conduct their own rough experiments in order to arrive at a conclusion, what direct value is there for them in the minute weighings of the experienced scientist?

The implication is that these experiments are too far

* C. Heigham : This JOURNAL, January, 1926, p. 905.

removed from actual farm conditions to give the farmer any practical guidance.

The New Survey Method.—Hitherto the experimental method has been regarded as the only method available for discovering and demonstrating improved methods of farming, and any attempt to discredit its use would have been mere destructive criticism. It now seems evident that a better method may be at hand, and although the arguments in support of it cannot at present be regarded as final, there need, at any rate, be no further reluctance to face the issues involved. The fact is that, when it comes to offering guidance to farmers, the wealth of practical knowledge to be gained from a systematic analysis of actual farm experience has been ignored.

In the course of using a comparatively recently developed method of economic research it has become obvious that such systematic analysis of actual farm experience is a fruitful source of enlightenment. The survey method of economic research, which is the method referred to, is devised primarily to study the economic aspects of farming, but in the course of so doing it necessarily brings under review the effects of differences in farm practices. The method is to collect records from farmers. These records contain details of the methods adopted by each of them, and the practical results obtained. An examination of this material at once reveals the divergence in practice adopted by different farmers, and it is possible to sort the records into groups according to these variations of practice. If a particular practice has marked advantages, then the farms which have been grouped together by reason of their adoption of that practice will display measurably better results than all other farms.

Take an actual example of the working of the method. In the course of an economic study of the growing of sugar beet, information was obtained, among other things, concerning the width of drilling on each farm and the yields obtained. By sorting the farms into two groups, first those drilling seed at a width of 20 inches and less, and secondly those drilling wider than 20 inches, and comparing the yields obtained under each method, the result shown in Table I was obtained.

It is at once apparent that a greater percentage of farmers obtained high yields in the case of those drilling at narrower spacings than in the case of those using the wider spacings. These facts refer to 130 farms all over the sugar beet growing areas of England.

TABLE I.*—SUGAR BEET. YIELD AND ROW SPACING (130 FARMS)

Yield		Row spacing			
Tons		20 in. and under		Over 20 in.	
Per acre		No. of cases	Per cent.	No. of cases	Per cent.
Under 7	..	8	9	5	11
7-10	..	25	29	19	43
10-13	..	38	44	16	36
Over 13	..	15	18	4	10
Total	..	86	100	44	100

The same problem was studied by means of field experiments in 57 centres under the direction of the Ministry of Agriculture. The total results have not been published in figures, but the results obtained by five of these centres in the West of England were as follows :—

TABLE II.†—SUGAR BEET. WIDTH OF DRILLING TRIAL.

Centre No.		Soil type	Weight washed beet per acre (tons)			
			1	2	3	4
11	..	Medium loam	9.3	—	8.2	8.2
23	..	Clay loam	10.9	11.8	9.6	—
24	..	Clay loam	—	10.8	—	8.5
25	..	Medium loam	13.3	12.9	—	12.2
26	..	Medium loam	6.8	—	—	6.5
Plot 1. 18 in. between rows.			Plot 3.	21 in. between rows.		
Plot 2. 19 in. between rows.			Plot 4.	24 in. between rows.		

The conclusions to be drawn from these two tables are not of great importance here, as they are given merely as examples of the two methods of attacking a problem of this kind. The vital issue is two-fold, first that the survey method is capable of reaching these conclusions, and secondly that in the case of the survey method the conclusions are drawn from the experience of practical farming—a *prima facie* claim upon the attention of the farming community, if the results are sound.

Let us examine more closely the reasoning upon which each of these investigations is based. In the field experiment, great care is exercised to obtain for each set of plots as equal conditions as possible in all respects other than the one to be studied. Thus, in the case of the experiment of drill-widths at each centre, the plots would be laid out on the same soil, with the same manures, the same cultivations, etc. Only the width of drill would be varied. That is the essential feature of the experiment, namely to hold constant all factors other than the one which is being studied. In the case quoted above the experiment was repeated on five different soils. The

* This Table and Table No. III are taken from *Agricultural Economics Research Institute, Occasional Notes*, Vol. 1, No. 4, 5 and 6.

† *University of Bristol, Department of Agriculture and Horticulture*, Bulletin No. 2, p. 19.

results obtained show that on these plots and under this set of controlled conditions narrower width of drilling gave a slightly better yield. Soil, however, is not the only factor involved when it becomes necessary to generalize from the experiment. Farmers do not all plough at equal depths ; they do not all prepare the seed bed with the same care ; they do not all manure in the same way ; nor do they all cultivate the same number of times, nor single at the same date, nor to the same distance. In plot experiments all these points are identical, but the very weakness of the results when they stand alone lies in the fact that they do not give any indication of whether the same results would follow the narrower drilling, no matter how these other influences varied. The plot experiment, therefore, as a step in the direction of farmers' education has this failing. It says to the farmer : " Turn over your soil at such and such a date, and to such and such a depth, cultivate so many times with a particular machine, manure in this way, sow at such and such a date, single at this or that date, and at a given distance. If you do all these things, drilling to narrower width will give the best results." To all farmers except a very few, however, some of these conditions will not apply, and for them the experiment will therefore be inconclusive.

The survey method, on the other hand, does not start from special conditions, nor does it attempt to generalize from them. It takes the growing of sugar beet at the different widths under all sorts of conditions of production, soil, climate and management. If, on the average, a markedly better result in favour of the narrower drill-spacing shows up through all the varying conditions, there is much stronger evidence to put before the farmer in favour of that practice.

Further, should it be necessary to see how far differences of soil affect the yield from narrower drills, a further grouping of the same records according to the farms having the same soil-type can be made. Similarly, if the records of a sufficient number of farms are available, it will be possible to measure the effect of all manner of varying conditions upon this problem.

It should be emphasized that the example quoted above is only a tentative working out of the survey method as applied to this particular type of problem. It is sufficiently remarkable, however, to serve to draw the attention of those responsible for agricultural education to its main features. These are, first that it bases its conclusions on farming experience, and

secondly, that it makes no attempt to generalize from specialized cases, but draws its lessons from a wide field of varied conditions. The principle of learning from the best progressive farmers is already accepted. It is no uncommon thing for a successful farmer to be held up as an example to other farmers. Like the plot experiment, this method of education has its uses, but it is as difficult to generalize from a single farm as it is to generalize from the results of plot experiments. They are both specialized cases. The survey method, while it adopts this same principle of learning from the farmers themselves, depends essentially upon the collation of the experience of many farmers operating under varying conditions. It should therefore be capable of yielding results suitable for general recommendation.

One further point remains with regard to the comparison between the plot experiment and this aspect of the survey method, and it is of great importance. Some of the defects which arise from the necessity for conducting plot experiments under a set of artificial conditions have already been shown, but there is an even more serious defect—the impossibility under such circumstances of relating the results to the economic factors of cost, and so to profit. It is true that attempts have been made to do so, particularly in recent years, but these attempts have only served to show that it cannot be done.

Take, for example, a recent experiment on the effect of intensive manuring on two varieties of wheat.* The results for the first year were as follows:—

1926-1927	<i>Total yields per acre as thrashed</i>		<i>Dry weight of grain as percentage of control</i>	<i>Value of thrashed grain per acre at current values</i>		
	<i>Straw</i>	<i>Grain</i>		£	s.	d.
Yeoman II—						
Normal manuring . .	30.0	24.7	100.7	13	5	5
Intensive manuring.	35.3	31.5	105.0	16	18	8
Squarehead's Master—						
Normal manuring . .	33.7	24.3	100.0	13	1	3
Intensive manuring.	37.9	29.9	100.0	16	1	5

The experiment was continued in the following year, yielding similar results, and the report states that “if the cost of application of the extra manures is regarded as balanced by the value of the increased quantity of straw, the financial results may be stated as follows:—

* This JOURNAL, Vol. XXXV, p. 760.

<i>Average for the two years</i>	<i>Additional cost of intensive manuring</i>			<i>Additional return from intensive manuring</i>			<i>Profit on intensive manuring</i>		
	Per acre			Per acre			Per acre		
	£	s.	d.	£	s.	d.	£	s.	d.
Yeoman II	2	12	7	3	19	2	1	6	7
Squarehead's Master ..	2	12	7	3	5	3	0	12	8"

The report rightly points out that this is not the whole story. The reader is warned "that caution is necessary in drawing conclusions from work lasting for two seasons only at a single centre." There are, however, other defects. The figures show that the additional manuring has paid with both varieties, but this is only known to be true "if the cost of the application of the extra manure is regarded as balanced by the value of the increased quantity of straw." Moreover, no account has been taken of the increased cost of harvesting and thrashing the larger quantity of straw and grain due to the intensive manuring, nor of the fact that the Squarehead's Master was badly lodged. The figures therefore, although interesting and even suggestive, are in fact, so far as the economic aspect of the matter is concerned, quite inconclusive.

In all experiments of this kind the conditions are so different from those of farming practice as to rule out the possibility of measuring what the differences in cost would be under normal conditions.

It follows that the plot experiment can only satisfactorily show its results in terms of physical output. It cannot give any real guidance as to cost or profit. It is for this reason, more perhaps than for any other, that the experimental method carries less weight than it is sometimes expected that it should, among those who view these matters in terms of business. Farming is a business, and the most conclusive experiment is always inconclusive when viewed from the business standpoint. The survey method, on the other hand, even in its present undeveloped state, gives every indication that in due course it will be able to carry the investigation a stage further and show its results in terms of profit and loss.

This point has again been tentatively studied in the case of the survey records of sugar beet production, from which Table III was compiled :—

Information of this kind cannot be regarded as final, but it does give an indication (in the words of the article from which it is taken) "that the man who drilled at less than 20 inches stood a better chance of making a greater profit in 1926 (the

TABLE III.—SUGAR BEET: PROFIT AND ROW SPACING

Profit or loss per acre	Row Spacing			
	20 in. and under		Over 20 in.	
	No. of cases	Per cent.	No. of cases	Per cent.
Losses up to £5	3	3	4	9
Profits up to £10	32	37	21	48
Profits of from £10 to £20	46	54	17	39
Profits of over £20	5	6	2	4
<i>Total</i>	86	100	44	100
Average (profit) ..	£10 3s. 0d.		£9 9s. 0d.	

year to which these figures relate) than the man who drilled at a greater width."

Results of this kind, being in terms of profit and loss, must surely make a ready appeal to farmers.

It is impossible to say that absolute reliability of result can be obtained, but it is evident that the method will, at any rate, be more reliable than the plot experiment method, when used for problems of this kind.

If it be conceded that the arguments here set out are sound, the implications may be briefly summarized by saying that in all cases where investigation of existing farm practices is involved, the approach should be along the lines of the survey method. The use of the experimental method should be confined to research institutes where study is made of those comparatively few problems which lie outside existing farm experience.

[*Note.*—An article dealing with the possibilities and limitation of practical experiments, in the nature of a reply to the foregoing article by Mr. Dixey, will appear in the next (August) issue of the JOURNAL, the writer being Dr. Charles Crowther, Principal of the Harper Adams Agricultural College.]

* * * * *

INFECTIOUS ENTERO-HEPATITIS OR "BLACKHEAD" OF TURKEYS

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THIS disease is popularly known as "Blackhead"—a name given by laymen, as it was considered that the head of an affected bird became purple or black in colour. This is, however, rarely the case. Furthermore, discoloration of the head is of little diagnostic value, being common to other avian maladies.

Blackhead is an infectious disease of turkeys and occasionally of chickens, characterized by thickening of the walls of the cæca (blind guts) and the formation of round, yellowish-green, necrotic areas in the liver. The disease is widespread in turkey-breeding districts and causes a heavy annual loss on many farms.

Species Affected.—Young turkeys are particularly susceptible, but adult birds, although more resistant, may contract infection at any period throughout life. Nearly all turkey poults on infected land contract the disease during the first few months of life; the majority of cases appear during the second or third month.

Chickens are also susceptible, but to a much lower degree, and the mortality is slight; nevertheless, they may act as "carriers" of the causal agent and be the means of introducing infection. By "carriers" are meant birds which harbour and transmit the causal agent, but which show no visible lesions of disease.

Causal Agent.—This is generally considered to be a protozoan organism, the *Amœba meleagridis* (Smith). There is, however, considerable diversity of opinion on this point, and more extensive investigations are necessary before it can be definitely decided.

Incubation Period.—In every contagious disease there is an interval between the time of infection and the appearance of visible symptoms; this is called the incubation period. With Blackhead it varies from ten days to four weeks.

Mode of Infection and Method of Spread.—The principal source of infection is land contaminated by the droppings of affected birds. It has been definitely proved that the recovered

bird, although apparently in good health, may act as a "carrier," and, by the excretion of the causal agent with the droppings, contaminate the land and give rise to a fresh outbreak of the disease. The parasites multiply rapidly in the intestines of young birds, and are passed out in enormous numbers with the droppings, to be picked up with the food by other birds of the flock. It is possible that earthworms may serve occasionally as mechanical carriers, but they are not true hosts, as their presence is not essential for the development of the parasite.

According to some authorities, the ingestion of infective eggs of the round worm *Heterakis gallines*, of the fowl may transmit the disease to turkeys. It is improbable that infection is transmitted by the eggs of "carrier" birds.

Once infection is introduced to a farm, it is difficult to eradicate it. This is due, in part, to the resistance of the parasite to external conditions, and also to repeated reinfection of the land by "carrier" birds.

It happens, occasionally, that in certain outbreaks the source of infection is obscure; in such cases it is possible that wild birds may have acted as carriers. There is, admittedly, no proof that wild birds can act as carriers, but it is a possibility that cannot be entirely ignored.

Symptoms.—The first symptom noticed in poults is that they are unable, through weakness, to keep up with the remainder of the flock. This is followed by drooping of the wings and tail, loss of appetite, and falling away in condition. A characteristic greenish-yellow diarrhoea is nearly always present.

The disease is very acute in young birds, and death may occur in a few days. Fatal cases in adult birds usually run a course of three to four weeks' duration. Mortality is generally from 70 to 90 per cent. in poults, and from 10 to 15 per cent. in adult birds. The disease is most prevalent during summer and autumn in poults, but may occur at any period in adult birds.

Post-mortem Appearances.—The lesions are confined to the liver and intestine. The liver is usually enlarged, and shows on the surface characteristic round, yellowish-green necrotic areas, varying in size from one-third to two-thirds of an inch in diameter. These necrotic areas extend deeply into the organ, while their external surface is slightly depressed below that of the surrounding liver tissue.



"Blackhead" lesions on the liver of a turkey.

Infectious Entero-Hepatitis OR "BLACKHEAD" OF TURKEYS.

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In the intestinal tract, the cæcum or blind gut is the part principally involved. One or both cæca may be affected. The walls become greatly thickened and covered internally by a greyish cheesy exudate, which at times causes marked distention of the pouches. The entire length of the cæcum may be involved, or the enlargement may continue to within a short distance of the blind end.

Diagnosis.—Blackhead is readily diagnosed from the characteristic necrotic areas on the liver and the thickening of the walls of the cæca.

Treatment.—No satisfactory method of treatment has yet been evolved. Many drugs have been tried and some recommended, but these have little, if any, curative value. It should be clearly understood that treatment of contagious disease in poultry, as indeed of animals in general, is a bad policy. Even on farms with modern equipment, where stringent precautions are exercised, it is practically impossible, if treatment is adopted, to limit the spread of infection. Once infection is allowed to establish itself, heavy losses are inevitable, eradication becomes difficult, and can be accomplished, eventually, only by a considerable expenditure of time and money. When due consideration is given, therefore, to the contagious nature of this disease, the risk of a widespread outbreak, and the time and expense involved in the frequent dosing of affected birds, it must be concluded that the policy of treatment is both economically and scientifically unsound.

All sick birds should be destroyed, and burnt or buried in quicklime. The in-contact birds should be isolated until such time as they can be disposed of for table purposes.

Prevention.—Precautions should be taken to prevent healthy birds contracting infection from contaminated ground. Flocks should not be allowed access to land upon which the disease has existed during the previous two years. Indeed, to obtain the best results with turkeys they must have a wide range, and if possible, even in the absence of disease, the flock should not be run over the same land for two successive years. The principal means by which the disease is introduced is by the purchase of infected birds. It is advisable, before purchasing stock birds, to establish beyond doubt that they are from a healthy flock. All newly purchased birds should be isolated for at least one month before being allowed to join the healthy stock.

When the disease has existed on a farm for some years, it is advisable to dispose of the infected stock and either give up breeding for a couple of seasons or start with healthy stock on fresh ground. On some badly infected farms, the confinement of flocks to enclosed yards has been tried with apparently favourable results.

When hatching is carried out by hens, every effort should be made to obtain these from farms free from coccidiosis, as the hen is frequently a chronic carrier of that disease and may transmit it to the young turkeys. On commercial turkey farms, it will repay the extra trouble entailed to breed the hens required for rearing turkey poults.

On infected farms where artificial incubation is practised, young birds should be confined to an enclosed piece of ground for the first three months of life. The area of ground required will depend on the number of birds bred. It should be sufficiently extensive to take a three months' output from the incubators. It should be reserved for young birds and, once birds have passed out from this enclosure, they should never be permitted to return. The ground should be left vacant between breeding seasons, and be dressed twice with powdered quicklime at the rate of two tons to the acre. This system, which is particularly suitable for incubator-hatched chicks, provides protection not only against Blackhead, but also against coccidiosis and intestinal parasites.

Every effort should be made to guard against the introduction of Blackhead, as its eradication is one of the most difficult problems with which the turkey breeder has to contend.

Disinfection.—The first and, perhaps, the most important part, of the disinfection of an infected building is the cleansing of the interior by scraping and sweeping. The droppings, scrapings, and litter should be burnt, or mixed with quicklime and removed from contact with birds. The walls and roosts should be scrubbed with hot water containing caustic soda (10 per cent.) to remove dirt and grease. This also acts as a disinfectant. The house may then be washed or sprayed with a disinfectant such as 5 per cent. solution of carbolic acid, 2 per cent. solution of compound cresol, or 2 per cent. solution of formaldehyde. The infected runs should be top-dressed with ground quicklime at the rate of two tons to the acre, and where practicable, ploughed up and left vacant for six months.

THE EMPIRE MARKETING BOARD AND AGRICULTURAL RESEARCH IN ENGLAND & WALES

A CONSIDERABLE portion of the Empire Marketing Fund has been allocated to agricultural research, and institutions in the home country (as part of the Empire) have received grants from that fund for such work. At the request of the Empire Marketing Board the Ministry has undertaken the administration of many of the grants to institutions in England and Wales. These institutions are almost exclusively research institutes, University Departments or Colleges, but in one case a grant has been made to a County Council institute.

The following are brief notes on certain grants for agricultural research from the Empire Marketing Board, administered by the Ministry. Reference is made in this JOURNAL periodically to other grants, chiefly but not entirely to assist work of an economic nature, which are made by the Ministry out of the annual grant which it receives from the Empire Marketing Board to develop the marketing of home agricultural produce.

Long Ashton Fruit Research Station, Bristol University.—Investigations into storage have shown that the keeping qualities of fruit are related to the kind of soil in which the fruit is grown; also that fruit from different orchards with the same type of soil may show material differences in storage quality. It is known, for instance, that when particular varieties of apple grown in certain places are stored, they break down internally, giving rise to Jonathan Spot, Bitter Pit and other disorders. These troubles are not due to storage, since apples stored under the same conditions but grown under different ones stand the test well.

A capital grant of £7,025 to meet the cost of an addition to the existing laboratories of the Station, a cold store, an orchard house, glass shelter and other minor items, and maintenance grants of £2,425 in the first year, rising to £2,750 in the fifth year, have been made for the purpose of the investigation. The staff employed on the investigation consists of a soil analyst, a biochemist and a physiologist.

East Malling Research Station.—Investigations carried out at East Malling have shown that different stocks behave in different ways when the same variety is grafted on to them. For instance, apple stocks have been typed, and it is known that one type will develop into a small bush giving crops of

well-grown, highly-coloured apples from the second year of grafting, while another stock, to which the same variety of scion is grafted, will produce a large tall tree which fails to crop in early years but will crop heavily later. With other fruits, too, it is found that certain stocks and scions are incompatible and grafts fail; in other cases the time of reaching maturity is affected. Disease resistance also varies with different combinations of stocks and scions. This work has now been extended in order to establish the principles which govern the relation of stocks to scions. A knowledge of these principles will enable a control over the behaviour of a tree to be established by selection of the appropriate stock and scion, and will provide a guide for the selection and standardization of the horticulturist's material.

The staff employed on the work includes a biochemist, a pathologist, a physiologist and a pomologist. Additional land has been acquired for the investigations, and a biochemical laboratory and equipment for the staff employed have been provided. The capital grant amounts to £9,050 and the maintenance grants vary from £5,218 in the first year to £5,685 in the fifth year.

Rothamsted Experimental Station.—In connexion with the investigation of diseases attacking cotton in Gezira, Sudan, the stage has been reached when accurate information regarding the role played by soil temperature and atmospheric humidity is required. The investigations indicate, so far, that soil temperature is intimately connected with the incidence of one of the most serious bacillary diseases of the cotton plant, *viz.*, Angular Spot or Black Arm. A grant of £800 for one year has accordingly been made to enable six "Wisconsin" tanks to be erected and maintained at the Station for the purpose of the investigation. These tanks consist of a thermostatic arrangement whereby the temperatures of the soil and the atmosphere can be controlled, thus enabling the conditions to be regulated under which physiological and pathological experiments on plants can be carried out.

Rothamsted Experimental Station and the Experimental and Research Station, Cheshunt.—Arising out of a recommendation of the Imperial Agricultural Research Conference, 1927, that "no time should be lost in the provision of funds for the more extended study of the fundamental nature of virus diseases in plants," grants have been made to the above Stations for such study. The capital grants amount to £1,835 in the case

of Rothamsted and £1,040 in the case of Cheshunt, and are for the purpose of erecting insect-proof glasshouses and special apparatus. The maintenance grants amount to £2,495 in the first year, rising to £3,115 in the fifth year, to Rothamsted ; and £1,108 in the first year, rising to £1,260 in the fifth year, to Cheshunt, and will enable a number of scientific workers to be employed on the problem.

Experimental and Research Station, Cheshunt.—The Red Spider causes considerable losses over a great part of the Empire. It attacks the carnation, cucumber, current, gooseberry, tomato, vine and hops. In the tropics the castor bean, cinchona, cotton and rubber are attacked. The present methods of control are extremely unsatisfactory, since the mites exhibit great resistance towards the insecticides in common use.

The White Fly is a serious pest which occurs wherever glasshouses are installed. A Chalcid parasite recently discovered subjects the fly to almost complete control. A stock of the Chalcid is maintained for distribution to growers.

Cladosporium is a fungus found on the beet, citrus, cucumber, peach, potato, tomato and water melon. It is known that temperature and humidity affect the incidence of tomato mildew, but the present data do not point to a reliable control. Continuous temperature and humidity records are being taken in commercial nurseries for correlation with the incidence of disease. Tests of fungicides are also being carried out.

Recent work on mosaic disease has indicated that, in the case of the tomato and cucumber, the disease is frequently transmitted in the seed, and it has been found possible to select seed which is free from the mosaic virus. The investigation is proceeding further on these lines.

For the purpose of the above investigations, a capital grant of £1,600 for the erection of experimental glasshouses, etc., and maintenance grants of £1,760 per annum for five years have been made. A special staff is being employed on the investigations.

Reading University.—The mycologist in the New Zealand Department of Agriculture recently reached the conclusion that the "dry rot" disease of swedes and turnips, which is very prevalent in that Dominion, is seed-borne, and that to combat the disease disinfection of the seed is necessary. Most, if not all, of the seed used in New Zealand is obtained from seed merchants in England, and it has been suggested that if the seed for the "mother" crop were treated before it is

sown in this country the resultant seed for export would be free from disease, and the New Zealand crops would, therefore, be healthy. Certain work done in this country some years ago tended to show that the disease was not seed-borne; but even if the disease could be traced to the seed, it is not clear that the disease is to be solely attributed to the sowing of infected seed. It appears certain that the "dry rot" disease is intimately bound up with a disease known as swede canker that attacks the seed-yielding plants. It follows that there is no certain proof that the disinfection of the "mother" seed will, in fact, result in a seed crop which will be entirely healthy.

A grant of £520 has accordingly been made for the purpose of an investigation into this problem. A mycologist is being employed to assist the advisory mycologist at the University, and the whole of the investigation is under the direction of the Ministry's Plant Pathological Laboratory.

National Institute for Research in Dairying.—Red Spot in cheese has been found during the past thirty years in Canada and in England. An organism has been isolated in infected cheese, but it seems likely that other organisms may produce a similar result. It is essential to isolate all such organisms, to study the sources from which they emanate and the exact conditions, *e.g.*, of acidity and storage, under which they produce the fault.

Fishiness is a well-known fault of dairy products, but appears to be most serious in the case of butter, particularly where it has to undergo storage for some time. A considerable amount of work has been done on the subject, but workers are not yet agreed as to the primary cause of the defect.

The results so far obtained have revealed the fact that the complete study of the causes of "red spot" in cheese and "fishiness" in butter cannot be undertaken without the provision of stores in which temperature and humidity can be accurately controlled.

A capital grant of £3,150 has accordingly been made for the erection and maintenance of a cold store in connexion with these investigations, together with maintenance grants amounting to £2,300 per annum. A bacteriologist and chemist are being employed on the work. The cold store will also be used in connexion with the investigation of other problems which involve a study of ripening processes in dairy produce.

Cambridge University.—The International Education Board have offered a grant of £700,000 for the building of the new

University Library and for developments in agriculture, biology and physics, on condition that the balance required under the scheme, viz., approximately £500,000, is raised from other sources. In order to enable the University to qualify for this grant, the sum of £50,000 has been promised from the Empire Marketing Fund conditionally on the University raising the further funds required. This grant is to be devoted to the development of research in agriculture and allied sciences. A further £50,000 on the same conditions has been promised to the University by the Government from the Development Fund for the extension of the work of the School of Agriculture.

Animal Nutrition Research Institute, Cambridge University.—

(a) In the production of eggs and table poultry, costings investigations have shown that 65 per cent. of the total cost of production is due to the cost of foods used. The possibility of effecting economies in the production of poultry products by a more exact knowledge of the scientific principles of feeding is obvious. From investigations already made by the Institute into the variation in composition of a typical egg-laying breed (White Leghorn), and a dual-purpose breed (Light Sussex), during the growing period, with the object of establishing the relative rates at which storage of protein, fat and mineral substances occur at different periods, it has been ascertained that the relative storage of protein in the body differs widely during various stages of growth, a sex difference in the storage of fat has been shown to occur, and the economic stage at which cockerels intended for table purposes should be killed has also been indicated.

A capital grant of £890 has been made for the purpose of providing accommodation for 200 adult stock, and an experimental house for controlled feeding experiments; and a maintenance grant of £330 in the first year, rising to £418 in the fifth year, will be used for the salary of a skilled worker to assist in the continuance of the research directed towards establishing a scientific feeding standard for poultry, the digestibility of the commoner poultry feeding stuffs—with particular reference to feeding stuffs of Empire origin, and an investigation into the physiological conditions concerned in the production of fat in the bird.

(b) Investigations have shown that grass can be conserved in cake form with its protein digestibility unimpaired (rather less, that is, than that of the best linseed cake). Such "grass

cake " appears to keep almost indefinitely, and successful feeding trials have been carried out on bullocks. In preliminary experiments on the replacement of oil cakes by grass cake in the ration of dairy cows the milk yield remained good and the weight of the beast increased.

With the object of exploring further, on a semi-commercial basis, the results already achieved, a grant of £200 has been made to the Institute for the erection of a full-sized silo.

(c) An investigation into the physiology of reproduction and growth of farm animals has been carried out at some disadvantage owing to the absence of adequate accommodation. A grant has been made to enable all the work to be concentrated at Howe Hill Farm and to provide accommodation to which the live stock can be transferred. The total cost of these arrangements is estimated at £16,000, of which £4,000 is being provided by the Board. A grant of approximately £300 per annum is also being made to cover part of the salary of an assistant to Mr. J. Hammond in this work. Mr. Hammond or his assistant will also be at the disposal of the Board for special visits to other parts of the Empire, if required.

In the course of investigations, in which pigs were kept without food for from three to five days, it was observed that whereas the white pigs maintained a steady body temperature, the black animals showed a fall in body temperature of approximately 1° F. for each day on which food was withheld. These investigations were on a very small scale, and it is now desired to repeat them on a large scale, since the facts observed might indicate some peculiarity in the metabolism of pigmented animals and perhaps that of pigmented human races. A grant of £1,000 has been made for the erection of a suitable animal house for the work.

Department of Animal Pathology, Cambridge University.—

In 1924, Professors Calmette and Guérin, of the Pasteur Institute, Paris, announced a new method for the prophylactic immunization of cattle against tuberculosis. This consisted of the administration to young calves of a living but avirulent culture of tubercle bacilli which was named by the originators B.C.G. bacillus. It was claimed that not only was this strain of tubercle bacillus completely deprived of its original virulence and incapable of producing the formation of tubercles in all species of susceptible animals, but that when introduced into the bodies of the non-tuberculous young of such animals it would produce a firm resistance to subsequent infection

with virulent strains of the organism. Preliminary experiments made at Cambridge, consisting of an intravenous injection of virulent bovine tubercle bacilli, which kill untreated control calves within three weeks, indicate that B.C.G. vaccine, when suitably administered, can produce a very high degree of immunity in calves as evidenced by their surviving the test dose. It is now necessary to test this method on a considerably larger scale in order to determine the reliability of the method, the duration of the immunity, the fate of the organisms used for immunizing and the fate of the organisms used for the test—whether given intravenously or acquired under natural conditions. To assist in this purpose the Board has made a grant of £3,000 for the erection of an additional twenty-two boxes for animals undergoing the test.

National Institute of Poultry Husbandry, Harper Adams Agricultural College.—This Institute is the largest section of the National Poultry Institute and is charged with the double duty of providing advanced instruction in poultry husbandry and of carrying out experimental work on a commercial scale. It is well equipped for teaching and experimental work in connexion, more specifically, with egg-production, but is only very slightly developed for the study of problems of poultry meat production and of the even more important question of the economics of the dual-purpose fowl. Experience has shown that experimental work on these problems is urgently needed.

A capital grant of £5,000 has accordingly been made for the provision of a complete marketing unit, comprising extension of headquarters building, marketing building, staff cottages, additional land, refrigeration outfit, live stock, laying houses, etc., together with maintenance grants of £1,581 in the first year rising to £1,816 in the fifth year. A statistician, a research assistant and a waterfowl expert are being employed on the investigations. Provision is made in the scheme for the study of the accumulated records of the Institute from the point of view of variation in egg weights.

Oxford University, Department of Zoology.—Previous investigations have shown that very many species of rodents in all parts of the world undergo great fluctuations in numbers in periodic cycles, and that these cycles are so regular that the course of events can often be predicted. Greater knowledge of the subject would therefore be capable of practical application in dealing with the economic problems which the direct and indirect effects of these fluctuations present. The investigations

carried out with the aid of a grant of £850 per annum for three years are :—

An intensive study of the exact mechanism underlying cycles in the numbers of wild mice ; experiments with cage-kept wild mice, in order to ascertain how breeding is controlled in the female ; experiments designed to test various ways of estimating the numbers of wild populations ; and co-operation with the Hudson's Bay Company in a study of cycles in numbers of Canadian furbearers and the study of the climatic factors which control the cycles over large areas.

The investigations are likely to make it more easy to protect farm crops from destruction by rodents.

Agricultural Economics Research Institute, Oxford University.

—With the aid of a grant of £700 per annum for five years, a research economist has been appointed to the Institute for the collection and dissemination of information relating to agricultural economics within the Empire. This worker will also be concerned with questions of technique in different economic conditions. There is still much to be learnt regarding the methods of approach to the problems of production in countries with widely different agricultural conditions, and regarding the methods by which data should be collected and results presented. The research economist will also be available in connexion with the training of any agricultural probationary officers who may be sent to Oxford by the Colonial Office, and his services will be at the disposal of the Empire Marketing Board for special investigations.

Welsh Plant Breeding Station, University College of Wales.—

In view of the importance of grass land in relation to the wool, leather, mutton, beef and dairy industries, research work is needed to select the best and most long-lived strain of each of the herbage plants, to determine the conditions in which they should be cultivated, and to indicate what countries of the Empire are best fitted to grow the supplies of seed required by other Empire countries.

Capital grants amounting to £4,350 have been made for the purpose of extending the Station's farm and for the erection and equipment of field laboratories to enable research into the production of improved pedigree strains of herbage plants to be undertaken and for the growing-on of supplies of such improved strains as are produced. Maintenance grants of £4,600 in the first year rising to £4,950 in the fifth year have also been sanctioned. Additional research workers will be employed to carry out this work.

John Innes Horticultural Institution.—The uplands of Iraq and Persia are the natural focus of the genus *Prunus*, from which emanated at a very early date all the economic forms of plums, cherries, almonds, peaches and apricots, with the exception possibly of certain plums, immediately of Japanese origin, but subsequently hybridized in America. The original specific forms from which the cultivated varieties originated are but partially known from a few individual representatives distributed in botanic gardens, yet it is mainly from these primitive and apparently unpromising forms that it is hoped to find material for the improvement of the present varieties by hybridization.

With the aid of a grant of £400 an investigator from the Institution is undertaking an expedition to the region mentioned to collect species and forms of *Prunus* and *Tulipa*; the latter genus is focussed in the same region, but is of botanical and horticultural rather than of economic interest. The region proposed (the mountain ranges between Mosul and Lake Urumia in Persia) is one of great botanical interest that has, as yet, not been botanically explored. An officer from the Royal Botanic Gardens, Kew, is participating in the expedition.

East Anglian Institute of Agriculture, Essex County Council.—*Spartina Townsendii*, or Rice Grass, has certain properties which appear to make it suitable as a binding agent for sea defences in temperate regions. It has a good mechanical effect and it gives a product of some economic value. It has been established by the Institute that the grass can be fed to animals and that it is at least as valuable as poor meadow hay. A grant of £220 has now been sanctioned to enable *Spartina* to be planted experimentally with a view to the prevention of erosion.

Imperial College of Science and Technology (London University).—A systematic study of the insect pests affecting stored food products has been undertaken by the Entomological Department of the College under the direction of Dr. J. W. Munro. With the object of indicating the nature, and reaching a solution, of the problems raised by these pests, detailed investigations are being made into the biology and habits of the insects infesting cacao, dried fruits and other products arriving at, or stored in, wharfs and warehouses, while special attention will be given to the sterilization of products arriving for immediate marketing in home ports.

The scope of the investigation, which started in 1927, has recently been extended, and a property at Slough has been acquired for the purpose of a field station, which, it is hoped, will become a centre for the training of entomologists in matters affecting stored food products infestation. The co-operation of important firms of wharfingers, merchants and manufacturers is being obtained so that full facilities will be available for the study of conditions prevailing in warehouses and for the collection of material for laboratory work. The chief end of the inquiry is to determine the extent of the losses on stored Empire goods caused by insect pests and the means of reducing such losses.

Capital grants amounting to £10,425 have been sanctioned in respect of apparatus and the acquisition and equipment of the field station, while maintenance grants on the extended scheme, rising from £2,195 in 1928-29 to £3,574 in 1931-32, have also been sanctioned. The staff now engaged on the investigation includes, in addition to the Director, a Mycologist, a Physical Chemist, a Demonstrator, a Bibliographer and four Research Assistants.

Royal Botanic Gardens, Kew.—Annual grants totalling £7,200 are made towards (1) the development of the cultivation of economic plants within the Empire, (2) the classification of herbarium specimens, and (3) herbarium assistance for the Dominions and Colonies. The grants are devoted (a) to the employment of an Economic Botanist who is available to undertake overseas missions or to set free a superior officer of the Kew Staff to visit the Dominions and Colonies and advise on agricultural and cognate problems, (b) to sending botanical collectors abroad to procure plants of economic importance, (c) to expediting the classification of large recent accessions of botanical material, and (d) to affording assistance to the Dominions and Colonies in the investigation of their respective floras.

Grants to the Ministry for the purposes of organizing Empire Conferences.—A grant of £5,000 was made to cover the expenses of the Imperial Agricultural Research Conference, 1927. Reference to this Conference has already been made in this JOURNAL (Vol. XXXIV, No. 10, January, 1928).

A grant of £500 has also been made to cover the cost of organizing the Agricultural Section of the Conference of Empire Meteorologists to be held next month (August).

"BLACK CANKER" OF THE BASKET WILLOW

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WITHIN recent years the basket willow crop appears to have suffered increasingly heavy losses from canker diseases. To the grower and merchant the term "canker" embraces all the unsightly wounds and deformities that greatly detract from the usefulness and commercial value of the rods. There are, however, two different types of canker caused by two quite distinct and specific parasitic agencies. One of these types results from the attacks of one or other species of rust fungus belonging to the genus *Melampsora*. The other is caused by the fungus known as *Physalospora miyabeana*, and may be distinguished as "Black Canker." It is with this that the present paper deals.*

The cankers on the peeled rods are familiar to all engaged in the basket-making industry. In the field, however, they are not as readily seen, and this fact has given rise in some quarters in the past to the misconception that most of the damage by the fungus is done after the rods have been cut and while they are standing in the pits. Almost the whole of the work of the canker fungus, however, is completed while the crop is still growing. The effect of the fungus is not confined to the rods themselves, as has hitherto been supposed, and it will be seen from what follows that the leaves and growing tips are also attacked. In fact, observations and experiments show, that normally, the fungus obtains entry into the willow plant through the leaves and succulent growing tips, and not, as was formerly supposed, through wounds or abrasions on the surface of the rod itself.

The earlier phases of Black Canker attack have, in the past, been attributed to fungi other than *Physalospora miyabeana*, this one having been regarded as merely a follower of other primary parasites. The investigations that have now been carried out, however, have proved that *P. miyabeana* is itself a virulent, primary parasite, capable of directly attacking the willow crop in all stages of its growth.

* For a more detailed account of this disease see Nattrass, R. M., "The *Physalospora* Disease of the Basket Willow," *Trans. Brit. Mycol. Soc.*, Vol. XIII, 1928, pp. 286-304, pls. xxiv-xxvii.

Description of the Disease.—In a willow crop approaching maturity the effect of the disease on the rods can be seen, if looked for, in the form of the familiar "cankers." These differ greatly in size. They vary from minute, shield-shaped or elliptical lesions or wounds in the bark, $\frac{1}{4}$ in., or less, in length on the younger parts of the rods, to elongated, deep-seated cankers on the older parts, extending to .3 or 4 in. and involving both bark and the underlying wood. The form of the canker itself also varies considerably. On the upper portions of the rods a mere discoloration and slight flattening of the surface may be noted; on other portions the bark may be torn and shrivelled, exposing the tougher fibres and even the wood underneath. Further, unsightly local flattening and lateral swelling of the rods may occur, especially on their lower parts, which may make them useless for commercial purposes (Fig. 1). Not infrequently the rod becomes so weakened at a cankered spot that it breaks at that point and the top then hangs down at a characteristic angle.

Careful examination of a canker in almost any stage of its development will reveal the presence of a number of minute "blisters" or pustules, barely visible to the naked eye but readily discernible with a small magnifying glass. These are the fruiting or spore-producing structures of the Black Canker fungus (*Phylospora miyabeana*).

The fructifications are of two kinds. The first to appear consist of compacted cushions of fungus threads or spawn, from the surface of which immense numbers of spores (conidia) are produced. When ripe, this cushion ruptures the outer layer of the bark, thus exposing the spores to the exterior. Under suitable weather conditions spores are produced in succession in such quantities that they can be seen as minute pink or colourless masses, protruding from below the surface of the bark. As soon as a drop of moisture comes into contact with these spore-masses, the spores become separated, and they are washed down by rain and dew to other parts of the rods, frequently coming to rest in the leaf axils. Owing to the dense growth of the willow crop, the swaying in the wind of the wet rods readily leads to the dissemination of the spores in all directions.

In a film of moisture each of these spores germinates in a few hours with the production of a short tube or filament six to eight times the length of the spore. At the end of this tube a swelling (*appressorium*) is formed which becomes firmly adherent to the surface of a leaf. With the aid of this organ



FIG. 1.

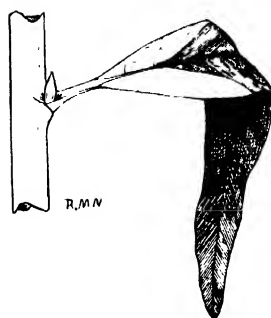


FIG. 3.



FIG. 2.

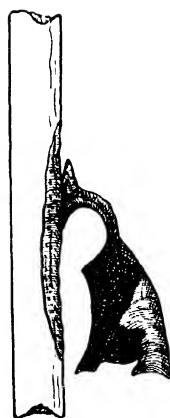


FIG. 4.

FIG. 1.—Cankers on peeled rods (left and right) and on a two-year-old stick (centre). The winter fructifications (*perithecia*) are present.

FIG. 2-4.—Showing progress of the disease and characteristic symptoms (diagrammatic). In Fig. 2, the fungus has penetrated the leaf at two points and produced discoloured areas; In Fig. 3, the infected regions have coalesced and the fungus is advancing along the mid-rib towards the stalk; in Fig. 4, the fungus has reached the main stem producing a canker; the dried leaf stalk remains attached.

“BLACK CANKER” OF THE BASKET WILLOW.

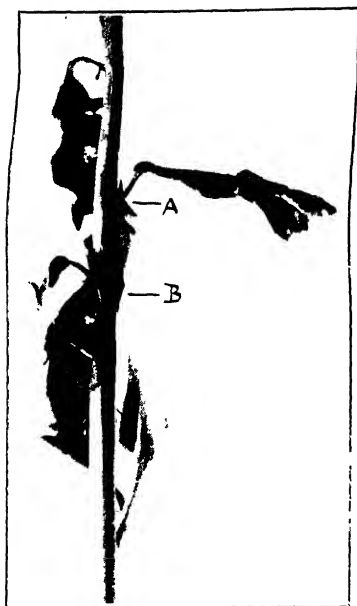


FIG. 5.

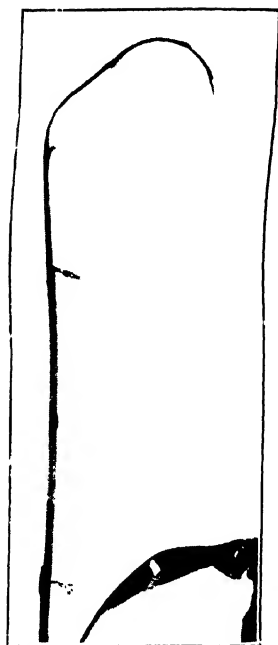


FIG. 6.



FIG. 7.

FIG. 5.—Succulent portion of rod showing at (A) passing of fungus from leaf into rod and at (B) a later stage of same. The leaf blade at (B) has already broken off but the stalk remains.

FIG. 6.—Young growing tip, attacked by willow canker fungus, bending over in characteristic fashion.

FIG. 7.—Showing tip "die back" and arrested development of young shoots following early infection by fungus. This may occur when stools are grown in the immediate vicinity of infected two-year-old rods.

'BLACK CANKER' OF THE BASKET WILLOW.

of attachment the subsequently developing tube or thread of the fungus is able to pierce the leaf epidermis and to pass into the tissues below. Here it extends and ramifies between the cells, causing discoloration and decay of the leaf tissue (Fig. 2). The discoloration varies from black to reddish brown, according to the variety of willow attacked. It may occur in small irregular-shaped patches, or it may extend over larger areas and involve the whole of the leaf-blade. There is a tendency for the developing fungus to advance along the midrib towards the leaf stalk, thus giving the lower discoloured portion of the blade a characteristic wedge shape (Fig. 3). When the upper part of the leaf has become involved it frequently bends sharply downwards. Eventually the whole of the leaf becomes blackened and the fungus continues to work its way down the leaf-stalk into the main stem, where it rapidly destroys the soft tissue of the bark (Fig. 4). Meanwhile the blackened leaf becomes dry and shrivelled, but it may remain attached to the rod for a considerable time. Eventually it falls off, but the remains of its stalk may persist throughout the season, and are usually to be found whenever a canker is examined (Fig. 5). Shortly after the appearance of the lesion on the bark of the rod at the base of the leaf-stalk, spore-bearing fructifications appear, similar to those already described. By the copious production and distribution of spores under favourable conditions throughout the summer, the disease is spread. The fact that the fungus enters the rod through the leaf is very important, and has, as will be shown later, a considerable bearing on the control of the disease.

Not only the leaves but also the young growing tips are susceptible to direct attack, and they may be affected at any stage of the growth of the crop. The earlier the attack the more serious will the consequences be. Should warm, close weather conditions prevail in early summer, when the rods are only a foot or two high, a "dying back" of the tips, caused by the fungus, may arrest their further development (Fig. 7). If the attack occurs later in the season, when growth has almost ceased, the effect is not so serious. In general appearance the diseased tips closely resemble those seen in the well-known "wither tip" disease of plum trees, bending over in a characteristic fashion (Fig. 6). Under favourable conditions and with a susceptible variety this phase of the disease may reach alarming proportions, few of the growing tips escaping, and the whole bed presenting a "blighted" appearance. In a very early attack the fungus has been

observed to work down the whole length of the young rod and actually to invade the tissue of the stool itself (Fig. 7).

Examination of affected rods will show that the cankers vary considerably in size and in position. Towards the end of the growing season all stages can generally be seen, from small lesions near the base of a leaf-stalk to deep-seated cankers situated towards the butt ends of the rods. In some cases there is simply discoloration and slight flattening ; or the bark may be cracked, exposing the fibres, and giving the wound a ragged appearance ; or, again, the entire rod may be girdled, the supply of sap to the portion of the rod above it being thus cut off. In other cases, especially near the butt ends, the actual wood is exposed ; but the wounds due to the canker fungus may appear to have healed owing to the formation of callus around their margins.

To account for these variations in size and position of the cankers it must be borne in mind that throughout the growth of the crop it is the upper more succulent portion of the rod, i.e., that bearing the younger leaves, that is most susceptible to attack, and that this susceptible region becomes higher and higher as the rods increase in length.

Not only is there a great elongation of the rod during the comparatively short growing period, but a considerable increase in its thickness also occurs. Attack on a leaf in summer, when the rod is about 3 ft. high, gives rise to a small canker near the base of the leaf-stalk, say, about 2 ft. above the stool. Considerable subsequent growth then takes place as the crop approaches the period of the year for optimum growth activity. At first the fungus makes headway, and the canker enlarges, but eventually the resources of the plant are brought to bear, and a barrier of cork cells and gum is formed which prevents further encroachment of the parasite. Meanwhile increase in thickness is taking place around the canker, tending to enfold the wound. Under conditions favourable to the plant the diseased tissue becomes completely isolated and may disappear, leaving a clean wound from which all external trace of the fungus has vanished.

A similar infection high up on the rod during the latter part of the growing season follows a different course. The fungus gains entry into the soft tissue of the rod through the leaf stalk, as before ; but, since growth activities are declining, little further thickening takes place. As the cork protection is inadequate owing to its slow growth, girdling of the rod may occur, with subsequent death of the upper portion of the shoot.

According to the old view, the cankers develop and extend after the rods have been cut and while they are standing in the pits. There appears, however, to be little evidence to support this. It is true that under unhygienic conditions certain other fungi (*Diaporthe* sp., *Cytospora* sp. and *Hendersonia* sp.) may follow the canker, but most of the damage is actually done in the field before cutting.

The pustules producing the summer spores described above do not persist throughout the season; after a time they give place to a second type of fructification. This is a more resistant one than the foregoing type and serves to tide the fungus over the dormant winter period. The fructifications consist of minute, flask-shaped vesicles (*perithecia*) enclosed in a hard carbonaceous matrix, which is buried in the soft tissue of the bark. Inside each vesicle a number of elongated sacs (*asci*) are present, each containing eight spores (*ascospores*). Each vesicle has a short neck open to the exterior through which, when mature, the spores are expelled. This type of fructification can withstand winter conditions, and it is the ascospores produced therein which, when liberated in the spring, start the new season's attack. The spores germinate and the fungus penetrates the leaves and young shoots in the same way as described above for the summer spores produced earlier.

At cutting time these winter fructifications can be seen on most of the cankers as minute blisters. When cankered rods are allowed to remain growing, in order to produce two-year-old rods, they obviously constitute a dangerous source of infection in the following spring, since the ascospores are readily washed down or splashed on to the young growth arising from adjacent stools. The intensity of the disease on "one-year" rods has been observed to increase as one proceeds towards adjacent two-year old beds containing cankered rods.

With the cutting of the one-year-old cankered rods much of the source of further infection is removed. There remain, however, the two-year-old rods, just mentioned, as well as pieces of cankered one-year rod lying on the ground. The latter source of infection is invariably present, and plays an important part in bridging the disease over successive crops. When once the production of summer spores has again commenced there is, of course, an abundant supply of infective material for the remainder of the season.

Varietal Susceptibility.—*P. miyabeana* is capable of attacking any variety of willow, but differences in the degree of susceptibility amongst the varieties exist. Commercial varieties of osiers generally, that are grown as closely massed crops,

suffer more than willows grown as isolated shrubs or trees.

Of the commercial varieties those of the species *Salix triandra* suffer severely, and *S. alba* var. *cardinalis* (the Golden Willow, grown extensively as a commercial crop) is particularly subject to attacks so severe as to render it worthless for economic use.

Salix purpurea (Bitter Willow), a species which includes some of the most valuable basket-making varieties, is also liable to suffer severely. In this variety leaf infection does not occur, and this is due apparently to the fact that the softly hairy or pubescent character of the leaf surfaces prevents the adhesion of drops of water or the formation of films of moisture, the presence of which is necessary to enable spores to germinate. Tip infection of the rod, however, is readily effected, with the result that the fungus, by traversing the tissues of the rods, may cause the death of the plants.

All varieties of the species *Salix triandra* are susceptible. The aggregate losses accruing with this variety are liable to be very extensive, because the acreage under it is greater than that of all the other varieties put together.

Salix americana is also particularly susceptible, but since this species is not grown extensively the economic consequences as far as loss of rods is concerned are not of much importance. Where beds of this species are grown near other more valuable varieties, however, the damage likely to occur by spore dissemination may become great.

Osiers (*Salix viminalis*) are susceptible to a slight degree. The damage observed in the varieties of this species has been trifling.

It has frequently been noticed that considerable development of the fungus may take place when cankered rods are cut and "bolted" in mid-autumn under mild moist weather conditions, for it will spread in the rods, generally in a downward direction. The commercial value which a "bolt" of *Salix cardinalis* may have had at the time of cutting in early November has been known to have been lost completely by the end of the same year.

Control measures.—No spray-fluid in common use is likely to have any direct contact fungicidal effect on either the winter or the summer fruiting bodies. The former are enclosed in highly resistant receptacles and the latter are borne on a thick cushion of interwoven fungal threads (spawn) which is capable of producing further crops of spores should those on the surface be killed.

It has been shown that the crop normally becomes infected through the leaves and the young tips of the rods, hence the protection of these against penetration by the fungus is indicated as a possible means of control. Experiments have proved that the spores of the canker fungus become killed if they germinate in contact with a toxic film on the surface of the leaf. Such a film can be produced by spraying the plants with a copper-containing fungicide such as Bordeaux mixture. This mixture, though considered by some to be troublesome to prepare, has the great advantage over other spray fluids that when *freshly* prepared from its ingredients—copper sulphate and lime—the deposited film persists throughout the greater part of the growing season. This fact is of great importance, because, owing to the dense growth of the willow crop, it is impossible to reach the lower portions of the rods with a spray-fluid as the season advances. Field experiments carried out by the writers have shown that not only can Black Canker disease be controlled to a considerable degree by spraying with freshly prepared Bordeaux mixture, but that the attacks of "Rust" (*Melampsora* sp.) are prevented.

The first application of the Bordeaux mixture should be made early, when the rods are from 6 to 9 in. high; at this time care should be taken to spray the stools thoroughly. The crop should be sprayed again at intervals of three weeks to a month, according to weather conditions, until further spraying is impracticable.

Owing to the nature of the willow crop, complete control of canker by spraying cannot be hoped for under field conditions; but the effect of two or three seasons' successive sprayings is likely to be cumulative, and should lead to a marked diminution in the intensity of the disease.

Further preventive measures lie in the adoption of a system of plantation hygiene, and in attention to cultural details, particular regard being paid to the following points:—

- (1) Close cutting of the rods to avoid cankers being left on snags.
- (2) Collecting and burning of as much as possible of the affected rods and their debris.
- (3) Clean rods only should be pitted for "White." It would be safer to "Buff" all badly affected rods, since the fungus would be killed during boiling.
- (4) In planting, special care should be taken to plant only clean, healthy sets, free from all traces of canker.

JULY ON THE FARM

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Seasonal Notes.—July may be either the most strenuous month of the twelve or one in which little effective work is possible, according to the weather conditions of this and the preceding month. In such a season as that of 1927 farmers had real difficulty in keeping their men usefully occupied, when owing to continuous wet weather it was futile either to work among the root crops or to move the mown grass—unless the object was to attempt to dry the grass by such special methods as those mentioned in these notes a month ago. Sometimes when a good beginning has been made in June with the hay crop, stacking is completed by the middle of July, leaving the second half of the month free for the recovery of any arrears of work in the roots and potatoes, the forking of hedge bottoms and field corners, the breaking up of old “seeds” for bastard fallowing, the clearing of calf pens and boxes, the painting of gates, vehicles, implements, etc., and—not of least importance—the preparation of the self-binders for their impending duty. Hedge-brushing is a common fill-up job, but of doubtful wisdom at this time of the year.

The reconstruction of cow-shed floors where necessary is particularly suitable employment for farm hands in a free time in July. The concrete sets quickly, the cows are out of doors and there is the maximum duration of daylight, so that the work can be completed rapidly. Floor-making with concrete is a comparatively simple operation and well within the skill of farm labourers. Many farmers apparently do not realize this, otherwise they would not continue to suffer the inconvenience associated with old-fashioned, long, low standings with uneven surfaces and narrow grips.

This year, it is feared, hay crops will be both late and light, and although root crops promise well, it would seem advisable to increase the provision for autumn and winter forage where possible. By top-dressing the seeds crop immediately after the hay has been cleared, one may secure an earlier and heavier aftermath, which can often be converted into hay. Turnips may still be sown, and weather conditions have favoured the cleaning, for this purpose, of land that might otherwise be bare until autumn. Where labour conditions will not permit of turnip growing, Italian rye-grass

may be sown in July or August with the object of producing a good bite of grass in March or green soiling in April, nitrates or liquid manure being applied as a stimulant in February.

Pasture Land.—In this month differences in quality of grassland become accentuated; and when July coincides with a spell of really hot, drying weather, fields of “rich old turf” demonstrate their claim to this title. Newly-formed pastures may do well from April to the end of June or the middle of July; but when put to the severest test, the white clover may run to seed and even burn up while the grassy components of the sward become dry and stalky. Hide-bound old pastures simply remain brown and lifeless after their May and June growth has been eaten off; and secondary qualities of old pasture fail to keep pace with the needs of the cattle that they maintained in the earlier part of the season. Rich old turf on the contrary continues sweet, green and productive in July.

Such pasturage is obviously of high value. Cattle fattening on land of this description attain ripeness early in the season, while prices generally favour the seller; their progress is not interrupted by a six weeks’ period of stagnation. Similarly, where the best quality of pasture is devoted to dairying, the customary drop in yield after June is less pronounced, and less expenditure on concentrates and soiling crops is needed.

Much can be done by adaptive seeding, fertilizing and good general management to establish productive pastures on comparatively dry soils, poor in humus; but the best grazing fields are undoubtedly found on soils which are capable of furnishing the grass roots with a steady and continuous supply of moisture and nitrogen. Without such supply, a close sward of sweet leafy herbage cannot be established and maintained, and without such a sward the soil surface is not sufficiently covered and protected to resist the burning effect of the sun and atmosphere of a hot July.

Recently there has been a tendency to underestimate the value of age in a sward. Age alone does not make a good turf; many old pastures could be improved by renovation; but one of the characteristics of rich pasture requires time for its development—viz., the surface layer of dark, humic soil. The skilled curator of lawns and greens knows the secret of making and keeping a close, fine and durable sward: it is the application of top dressings of rotted leaf mould. The enrichment of the soil surface with non-acid humic material in this

manner cannot be exactly applied to pastures ; but the same result is gradually attained by good management. The surface layer becomes enriched in humus by the decay of leaf and stem and the droppings of stock, especially if the latter are regularly knocked and distributed. Earthworms assist in the work by casting up fine soil intimately mixed with the residues of the vegetable matter on which they have fed. It is essential, however, to maintain conditions favourable to the decomposition of dead vegetation : sufficiency of lime and reasonably close grazing. Acid conditions and excessive accumulation of dead stemmy tissue lead to the formation of a "hide" or "mat," under which fine grasses and clovers cannot develop.

The uniformity with which good pastures graze off gives the impression that they are managed with comparative ease. Admittedly, when uniformity in quality of herbage has been attained, even grazing may be secured without punishing the cattle, as would be unavoidable if the stock were confined to a patchy field until they had bared off the rough as well as the sweet places. After attention to fencing and water requirements, therefore, an endeavour should be made to bring about uniformity of herbage. Cattle as well as horses prefer to graze places that were eaten short last year and they again leave the patches that were rejected and ran to seed. The best preventive and corrective of patchiness is the mowing machine. Curiously enough, cattle will often consume half-dried fodder lying in swath where they refuse to graze ; but they will bare-off the young growth that springs up in the track of the mower, thereby improving it for next year's grazing. To complete the treatment, however, the mown places should be separately top dressed with appropriate minerals.

Poor Heavy Land.—It may be difficult for the modern farmer to realize that formerly it was the occupier of light land who had the hardest struggle for existence. When corn was the main source of farm income and bare-fallowing the only means of eradicating weeds and restoring fertility, clays were preferred to sands and loams for arable cropping. To-day, potatoes, sugar beet and fodder roots are the pivotal crops in the rotation ; all these are grown most successfully and at least labour cost on free-working soils. Land that does not lend itself well to green crop cultivation, and if necessary to sheep folding, is not now attractive for arable farming.

Much of the wheat-and-beans land of the midland and southern counties was laid down to permanent grass during the expansion of the milk industry in the last quarter of the nineteenth century. The grassing policy continues, but there are in many districts still considerable areas of strong soil which it is difficult to utilize for anything but arable cropping. The profitable cultivation of such soils under present conditions is one of the most complex of all agricultural problems.

Mr. A. W. Oldershaw, of East Suffolk, in introducing a discussion on this topic (*Agricultural Progress*, Vol. VI.) submits that help in the solution of this problem may be found in :—

1. The more extensive adoption of mole drainage ;
2. An increased use of artificial manures ;
3. Increased production and better conservation of yard manure ;
4. The growth of silage crops, lucerne, and clovers for seed ;
5. The adoption of temporary leas ; and
6. An extended use of both steam and tractor power.

When watering and fencing conditions will permit of the grazing of temporary leas, suitably seeded and fertilized, there is no doubt as to the value of their inclusion in the cropping of heavy soils. Apart from their benefit in the matters of humus, nitrogen and soil texture, cloverly leas suppress weeds and reduce the need for so frequent bare-fallowing. The alternation of a series of grain crops with a 3–4 years' lea of grasses and wild white clover, pen-fallowing the lea with mechanical power in July, may go a long way towards solving the heavy land problem.

* * * * *

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended June 19.				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	10 13d	10 13d	10 13d	10 13d	13 9
Nitro-chalk (N. 15½%) ..	10 0f	10 0f	10 0f	10 0f	12 11
Sulphate of ammonia:—					
Neutral (N. 20·6%)..	10 13d	10 13d	10 13d	10 13d	10 3
Calcium cyanamide (N. 20·6%)	9 16e	9 16e	9 16e	9 16e	9 6
Compound white nitrates lime and ammonia B.A.S.F. (N. 15½%) ..	..	10 10h	..	..	..
Kainit (Pot. 14%) ..	3 6	2 19	2 19	3 2	4 6
Potash salts (Pot. 30%) ..	5 3	..	4 17	5 1	3 5
„ (Pot. 20%) ..	3 15	3 9	3 8	3 12	3 7
Muriate of potash (Pot. 50%)..	9 17	9 3	9 2	9 0	3 7
Sulphate,, „ (Pot. 48%)..	11 19	11 6	11 5	11 5	4 8
Basic Slag (P.A. 15½%)||	2 8c	2 2c	..	2 9c	3 1
„ (P.A. 14%)||.	2 3c	1 16c	1 16c	2 4c	3 2
„ (P.A. 11%)||.	..	1 9c	1 9c	..	..
Ground rock phosphate(P.A.26· 27½%) ..	2 10||	2 7||	..	2 5a	1 8
Superphosphate(S.P.A.16%)..	3 7	..	3 6	3 6	4 2
„ (S.P.A.13½%)..	3 2	2 15	3 0	3 0	4 4
Bone meal(N.3¼%,P.A.20¼%)..	8 15	8 10	8 12	8 0	..
Steamed bone flour (N. ¼%, P.A. 27½-29¼%) ..	5 17b	..	6 10	5 10	..

Abbreviations: N.=Nitrogen; P.A.=Phosphoric Acid; S.P.A.=Soluble Phosphoric Acid; Pot.=Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

‡ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 80% through standard sieve. a. 85% through standard sieve.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra. Rebate of 1s. per ton will be allowed.

e Delivered in 4-ton lots at purchaser's nearest railway station. Rebate of 1s. 3d. per ton will be allowed.

f Prices for 2-ton lots. Rebate of 1s. per ton will be allowed.

A F.O.R. Gpale.

* * * * *

NOTES ON FEEDING STUFFS

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The Balance of the Ration.—In last month's issue of this JOURNAL, the writer dealt with the function of protein in the nutrition of farm animals. It was shown that every animal must receive a certain minimum amount of protein in its daily food to satisfy the demands of maintenance and production.

The particular case of the dairy cow may be considered. The ration of the dairy cow must supply the following amounts of nutrients : (1) Sufficient starch equivalent for the maintenance of body temperature, heart beat, blood circulation and other unconscious bodily processes, and for the provision of energy for conscious muscular activity ; (2) sufficient digestible protein for the repair of "worn-out" body tissue ; (3) additional starch equivalent and digestible protein corresponding with the animal's capacity for milk production.

It is now recognized that *the maintenance requirements* of the dairy cow, on the basis of 10 cwt. live-weight, are supplied by an amount of food containing 6.5 lb. of starch equivalent, including 0.7 lb. of digestible protein. For this purpose, such feeding stuffs as straw, hay, silage and roots are usually employed, and the following rations may be cited as typical maintenance rations : (1) 14 to 20 lb. meadow hay, the amount being dependent on the quality of the fodder ; (2) 12 lb. good meadow hay and 45 lb. mangolds ; (3) 22 lb. silage, 4 lb. oat straw, and 11 lb. meadow hay. Such rations as these furnish approximately the starch equivalent and digestible protein requisite for maintenance.

The production requirement of the dairy cow has been the subject of inquiry by a committee appointed a year or two ago by the Ministry of Agriculture. This committee has adopted 2.5 lb. of starch equivalent, including 0.6 lb. of digestible protein, as the standard requirement for producing 1 gallon of milk. Strictly speaking, however, these data apply only to breeds, such as Shorthorns, which yield milk containing about 3.7 per cent. of fat. In the case of Jersey cows, giving a high quality of milk containing as much as 4.9 per cent. of fat, the food requirement per gallon of milk rises to 3 lb. of starch equivalent, including 0.7 lb. of digestible protein. When rationing for milk production, it is in general necessary to employ a mixture of cereal and oil seed products so adjusted that it contains about 75 per cent. of starch equivalent and 20 per cent. of digestible protein. This mixture should then be

used at the rate of $3\frac{1}{2}$ lb. for every gallon of milk. For more detailed information about the feeding of milch cows, however, the reader is referred to Professor T. B. Wood's text book on *Animal Nutrition* and Mr. G. H. Garrad's treatise on *The Principles of Dairy Farming*.

It will now be of interest to inquire into the consequences of keeping a dairy cow on a ration which contains less protein than is required for maintenance and production purposes. The yield of milk does not fall off immediately, the natural tendency in the animal being to maintain the flow of milk, on which, under natural conditions, the welfare of its progeny depends. Under such conditions of deficient protein supply, the dairy cow draws on its own body tissue for the purpose of securing a sufficiency of protein for elaborating the proteins (casein and albumin) of the milk secretion. As a consequence, the animal begins to lose flesh and to run off in condition. A continuance of this process would inevitably, in the long-run, result in the death of the animal, since protein constitutes the structural material of its organism. Before this becomes imminent, however, a further change sets in. It would almost appear as if Nature were designedly anxious to preserve the existence of the maternal animal. The yield of milk now begins to fall off, and continues to do so, until the amount of protein in the diminished milk yield comes into balance with the amount of digestible protein in the deficient production part of the ration. In other words, an approximate equilibrium is ultimately established between protein intake and protein losses in the milk and excreta.

It will be seen, therefore, that a deficiency of protein in the ration of a dairy cow leads primarily to a loss of condition in the animal and secondarily to a much swifter falling off of milk yield than would be the case if the ration had been adjusted to meet the initial requirements of the animal. The question of protein supply, however, is not the only matter to which attention should be directed. In addition to an adequate supply of protein, the ration must also furnish a sufficiency of energy and heat-forming constituents (i.e., carbohydrate and oil) to meet the requirements of the animal for energy and warmth and for the formation of the non-protein substances of the milk. A deficient supply of such non-protein ingredients in the diet leads to the animal using up its own glycogen and fat reserves for such purposes, or, alternatively, utilizing a portion of the protein in the ration for conversion into heat and energy instead of into milk protein.

Here, again, the consequence is a running-off in condition and, later, a quick falling-off of milk yield.

Similar considerations govern the management of all types of farm stock. The optimum results with any animal are only possible when the daily ration supplies the correct amount of energy (or starch equivalent) and also an amount of digestible protein adequate for both maintenance and production. The feeding of animals will be both efficient and economic when the food supply contains neither an excess nor a deficit of starch equivalent in relation to actual requirements, and when the correct *balance* is struck between the digestible protein and digestible non-protein constituents of the ration.

The science of animal nutrition is mainly concerned with the securing of such information as will render possible the efficient and economic feeding of farm animals. Research in this branch of biological science is directed towards the solution of the following problems: (1) What are the energy and protein requirements of the different classes of farm animals at the different stages of their life-histories? (2) What are the capacities for food consumption of farm animals at different ages and live-weights? (3) What are the capacities of the available feeding stuffs for supplying the requirements of farm animals?

In the accompanying table, data are given showing the food requirements, on the basis of present knowledge, of a number of typical farm animals.

TABLE OF SCIENTIFIC FEEDING STANDARDS

			Capacity for food consump- tion in lb. dry matter per day	Scientific standards lb. starch equivalent	lb. digestible protein
3-gallon cow	..	..	30	14	2.5
5-gallon cow	..	..	30	19	3.7
10-cwt. steer (beef pro- duction)	..	..	24	12.5	1.5
6-cwt. steer (for "baby beef")	..	..	17	9.2	1.4
13-cwt. steer (fattening)			28	15.9	1.8
100-lb. sheep (fattening)	..		3.5	2.2	0.25

If the available feeding stuffs are employed for the purpose of making up rations with the characteristics shown in the above table, then such rations will contain sufficient energy and possess the correct balance for the several purposes. It must be borne in mind, however, that the desired amounts of starch equivalent must be contained in not more than the weights of food indicated in the column of consumption capacities. Manifestly, in designing rations for farm animals,

three primary factors must receive attention—energy content, balance and bulk. Other factors, such as vitamin content, mineral content and mineral balance, also need consideration, however. In previous articles the writer has demonstrated that properly-balanced rations of the common feeding stuffs usually contain an ample supply of the different vitamins for the well-being of farm animals. Trouble is much more likely to arise from actual deficit of minerals, or from badly-balanced mineral supply.

From the standpoint of protein, the correctly-balanced ration aims at supplying that amount of digestible protein which scientific investigation has shown to be necessary for the dual purposes of maintenance and production. The feeding of less than this amount of protein admittedly spells danger to the animal. What if this amount be exceeded? Does the alteration of the balance in this direction lead to less efficient and economic feeding? Does an excess of protein above the actual requirements lead to harmful effects in the animal?

It has been shown in an earlier article that the nitrogen contained in such excess of protein is not utilized productively in the animal, but is excreted into the urine in the form of urea. It was also shown that such surplus protein functions like carbohydrate and can, according to circumstances, serve as a source of heat and energy or of body fat. At the time of the early investigations into the protein requirements of farm animals, the carbohydrate-rich foods, usually grown on the farm, were much cheaper sources of nutrient than the foods rich in protein. It was, therefore, an uneconomic use of feeding stuffs to feed a surplus of protein, when such excess of an expensive constituent had merely the value of the cheaper carbohydrate to the animal. Further, it was recognized that the elimination from the organism of the urea corresponding with the surplus protein might throw too heavy a burden on the kidneys, and that the effects therefrom might be harmful to the animal. By such stages of reasoning, the balanced ration appears to have developed into an entirely rigid conception, the underlying principle being that a ration should contain neither less *nor more* than the minimum protein requirements of the animal and that the further requirements should be supplied in the form of carbohydrate and oil.

It appears possible to the writer, however, that this view of the making-up of rations for farm animals may be too narrow and inelastic, and not always in accord with the experiences of feeders of stock. For some time past, the writer has been

advocating the use of carbohydrate-rich foods for supplementary feeding on pasture, the reason for this being that well-managed grass supplies all the protein necessary for maintenance and production in the animal, especially in the fattening animal. Against this, however, is to be set the traditional practice of using oil cake as the supplement to the feeding of fattening stock at pasture, a practice which is claimed by the farmer to produce a finish in the animal which can be obtained in no other way. The writer recalls being told of an amusing incident relating to an experiment carried out very many years ago to demonstrate the ability of sheep to do well on good pasture without the aid of supplementary food. The experiment appeared to proceed very successfully and the animals, after a prolonged period of grazing, were in excellent condition. It transpired later, however, that the farmer, under whose control the experiment had been placed, had omitted to leave out the allowance of soya bean cake which the animals had been receiving before the commencement of the grazing trial!

That sheep may safely be kept on protein-rich diets is further borne out by the results of a striking experiment carried out recently in Cambridge by the writer's colleague, Dr. J. Stewart. In an attempt to determine the causes of the condition known as "pulpy kidneys" in sheep, Dr. Stewart kept two wether sheep on a diet of linseed cake over a period of about twenty weeks. Each sheep received about 3 lb. of linseed cake daily and no other food of any kind was given. The animals remained in surprisingly good condition throughout the trial, a circumstance which was specially commented on by numerous farmers who visited the Institute during that season. Moreover the weight gains of the sheep over the whole period were such as would have been anticipated from a knowledge of the starch equivalent of linseed cake. The animals were slaughtered at the end of the trial, and a post-mortem examination of the kidneys revealed no trace of disease.

It is difficult to resist the conclusion, therefore, that in the rationing of the *fattening animal*, the minimum protein requirements may be exceeded, at least within moderate limits, without endangering the rate of progress of the animal or prejudicing its general well-being. The main consideration here appears to be that the animal should get *sufficient* protein for its requirements. Whether a similar statement would hold true in respect of the *milking animal* is much more dubious. The opinion is often expressed by reliable practical men that

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	—	—	9 17	0 13	9 4	72	2 7	1.38	9.6
Barley, British feeding ..	—	—	9 15	0 10	9 5	71	2 7	1.38	6.2
" Canadian No. 3 Western	32 9	400	9 3	0 10	8 13	71	2 5	1.29	6.2
" " No. 4	31 6	"	8 17	0 10	8 7	71	2 4	1.25	6.2
" " feed	30 0	"	8 8	0 10	7 18	71	2 3	1.20	6.2
" " American ..	30 0	"	8 8	0 10	7 18	71	2 3	1.20	6.2
Oats, English, white	—	—	10 0	0 11	9 9	60	3 2	1.70	7.6
" " black and grey	—	—	9 17	0 11	9 6	60	3 1	1.65	7.6
" Canadian feed	25 6	320	8 18*	0 11	8 7	60	2 9	1.47	7.6
" Argentine	24 9	"	8 13	0 11	8 2	60	2 8	1.43	7.6
" Chilean	23 6	"	8 5*	0 11	7 14	60	2 7	1.38	7.6
" German	27 3	"	9 10	0 11	8 19	60	3 0	1.61	7.6
Maize, American	38 9	480	9 2*	0 10	8 12	81	2 1	1.12	6.8
" Argentine	37 3	"	8 13	0 10	8 3	81	2 0	1.07	6.8
Peas, Japanese	—	—	19 5*	1 2	18 3	69	4 5	2.37	18
Dari	—	—	8 15*	0 12	8 3	74	2 2	1.16	7.2
Millers' offals—									
Bran, British	—	—	6 5	1 3	5 2	42	2 5	1.29	10
" broad	—	—	7 7	1 3	6 4	42	2 11	1.56	10
Middlings, fine, imported	—	—	7 12	0 18	6 14	69	1 11	1.03	12
" coarse, British	—	—	6 17	0 18	5 19	58	2 1	1.12	11
Pollards, imported	—	—	6 10	1 3	5 7	60	1 9	0.94	11
Meal, barley	—	—	9 15	0 10	9 5	71	2 7	1.38	6.2
" maize	—	—	10 5	0 10	9 15	81	2 5	1.29	6.8
" " South African	—	—	9 2	0 10	8 12	81	2 1	1.12	6.8
" " germ	—	—	9 5	0 16	8 9	85	2 0	1.07	10
" locust bean	—	—	9 10	0 8	9 2	71	2 7	1.38	3.6
" bean	—	—	12 15	1 5	11 10	66	3 6	1.87	20
" fish	—	—	19 10	3 9	16 1	53	6 1	3.26	48
Maize, cooked flaked	—	—	11 10	0 10	11 0	85	2 7	1.38	8.6
" gluten feed	—	—	10 7	1 0	9 7	76	2 6	1.34	19
Linseed cake, English, 12% oil	—	—	13 10	1 10	12 0	74	3 3	1.74	25
" " " 9% ..	—	—	13 0	1 10	11 10	74	3 1	1.65	25
" " " 8% ..	—	—	12 10	1 10	11 0	74	3 0	1.61	25
Soya bean	—	—	11 2*	2 2	9 0	69	2 7	1.38	36
Cottonseed cake, English	—	—	—	—	—	—	—	—	—
" " " 41% ..	—	—	7 7	1 9	5 18	42	2 10	1.52	17
" " " Egyptian, 41% ..	—	—	7 0	1 9	5 11	42	2 8	1.43	17
Coconut cake, 6% oil	—	—	10 12	1 5	9 7	79	2 4	1.25	16
Ground-nut cake, 6.7% oil ..	—	—	9 5	1 8	7 17	57	2 9	1.47	27
Decorticated ground-nut cake, 6.7% oil	—	—	11 17*	2 3	9 14	73	2 8	1.43	41
Palm kernel cake, 4.5% ..	—	—	9 10*	0 18	8 12	75	2 4	1.25	17
" " " meal, 4.1% ..	—	—	10 0*	0 18	9 2	75	2 5	1.29	17
" " " meal 1.2% ..	—	—	9 0*	0 19	8 1	71	2 3	1.20	17
Feeding treacle	—	—	6 0	0 9	5 11	51	2 2	1.16	2.7
Brewers' grains, dried ale ..	—	—	8 5	1 0	7 5	49	3 0	1.61	13
" " " porter ..	—	—	7 15	1 0	6 15	49	2 9	1.47	13
Malt culms	—	—	7 15*	1 8	6 7	43	2 11	1.56	16

* At Bristol.

† At Hull.

‡ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of May and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.43d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 4d.; P₂O₅, 8s. 10d.; K₂O, 8s. 6d.

harm is being done at the present time in many good dairy herds by over-feeding of protein. It would appear advisable in the case of the dairy cow, to restrict the protein supply to about the minimum amount required for maintenance and milk production.

In conclusion, it is desirable to point out that the foregoing critical remarks are intended to be mainly suggestive, rather than expressive of actual conviction. Too often the real significance of a system is apt to become confused when the circumstances surrounding its origin have become obscure. This is well illustrated by the mis-use which is not infrequently made

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	8 14
Maize	81	6.8	8 17
Decorticated ground nut cake	73	41.0	11 17
" cotton cake	71	34.0	11 10

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2.25 shillings, and per unit protein equivalent, 2.17 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1928, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	9 3
Oats	60	7.6	7 11
Barley	71	6.2	8 13
Potatoes	18	0.6	2 2
Swedes	7	0.7	0 17
Mangolds	7	0.4	0 17
Beans	66	20.0	9 12
Good meadow hay	37	4.6	4 13
Good oat straw	20	0.9	2 7
Good clover hay	38	7.0	5 1
Vetch and Oat silage	13	1.6	1 13
Barley straw	23	0.7	2 13
Wheat straw	13	0.1	1 9
Bean straw	23	1.7	2 15

of starch equivalents. This much may be asserted with confidence, however, that no farmer ever went far wrong by computing and balancing the rations of his animals according to the accepted scientific principles. The writer has no hesitation in recommending these principles to all those farmers who aim at safety, economy and efficiency in the management of their stock.

NOTE.—*From the next (August) issue of the JOURNAL onwards, the "Notes on Feeding Stuff" will be contributed by Mr. H. G. Sanders, M.A.*

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MISCELLANEOUS NOTES

IN order to satisfy a widely-felt desire of horticulturists, as expressed through the National Farmers' Union, the Ministry arranged in April, May and June this year, in conjunction with County Authorities, demonstrations of horticultural machinery at five centres in the principal fruit-growing districts of the country.

The centres were Hounslow, Middlesex ; Wisbech, Isle of Ely ; the Long Ashton Research Station, Bristol ; Allington, near Maidstone, Kent ; and Evesham, Worcestershire. The implements demonstrated included a number of the most up-to-date tractors, both of the wheel and track-laying types, hauling ploughs, harrows and cultivators, many of which were specially designed for orchard use. A number of small power-driven implements, for use principally in orchards interplanted with soft fruit, were also demonstrated.

A neostyled leaflet was issued by the Ministry, explaining in general terms the objects of the demonstrations, and this was distributed at the various centres. The following extract from it may prove of general interest :—

Machinery which is to be used for cultivating fruit plantations is subject to certain limitations of height and width which, generally speaking, do not affect machinery designed for use in purely agricultural operations. For orchard work the machines must be capable of working close up to the trunks of the trees, of passing under the spreading branches of standards, and of turning on the narrow headlands without damaging the trees. In the case of motor units easy control is essential.

The operations which the machinery is normally required to perform are those designed to maintain from April to August a soil free from weeds and in the state of a fine loose mulch. This can be done with the use of the following four types of implement :—

(1) *Ploughs* which invert the soil and place the weeds underneath. These implements may have one, two, three or

even four furrows and are usually fitted with specially designed mouldboards either for shallow ploughing or deep ploughing as the case may be.

(2) *Cultivators with fixed tines or with spring tines* which disturb the soil without inverting it and leave the weeds on the surface so that they can be harrowed off. These vary in size according to the power available for hauling them. Spring-tine cultivators are not as a rule so efficient as those with fixed tines on account of the tendency of the tines to jump out of the ground on striking hard patches or accumulations of twitch.

(3) *Disc harrows* which break up the surface by the grinding and rolling action of the discs as the implements are drawn over the ground leaving the weeds on the surface. These implements should not be used when twitch is present as they tend to spread the weed by cutting up the roots.

(4) *Rotary tillers* which disintegrate the soil by means of tines revolving at a high speed and throw out the weeds on to the surface.

When sufficient power is available in the tractor a set of disc harrows may be hitched behind the cultivator.

Grubbing trees and tree stumps.—Trees may be quickly grubbed up by using a high-powered tractor that has a good soil grip. A stout chain is fastened round the tree trunk about 3 ft. from the ground with the other end attached to the tractor. One stout pull is usually sufficient to take the tree (roots and all) right out of the ground. It is a quick and cheap method for clearing the ground of spent trees.

The introduction of machinery into horticulture has somewhat lagged behind the mechanization of the farm, but in recent years the special difficulties involved have been largely overcome and there are now on the market a number of tractors and implements suitable for work in orchards.

The Ministry felt that the time had come when horticulturists should be given the opportunity of seeing at work some of the more modern machinery, in order that they might judge for themselves whether its introduction into their practice would be economic and would help them to reduce their production costs.

The demonstrations, which were carried out under the direction of the Ministry's Machinery Officer, Mr. Thompson Close, were well attended and much interest was displayed by fruit growers in the work performed with the various implements.

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THE Ministry's annual report on the acreage and production of crops and the number of live stock in England and Wales in 1928 was issued on May 30. The report

**Agricultural
Statistics
(Part I), 1928**

contains information as to the acreage of crops, the number of livestock (including poultry) and the number of agricultural workers actually in employment on June 4 as returned by the occupiers of agricultural

land exceeding one acre in extent. Particulars are also given of the production of the various crops and of livestock products including meat, milk, cheese, eggs and wool. The tables attached to the report contain detailed figures for each county in England and Wales of the acreage under each crop, the numbers of each class of live stock and the estimated yield per acre of the principal crops for the years 1928 and 1927. Summaries for Great Britain and Ireland for the last ten years are also given.

The report forms Part I of the Agricultural Statistics of England and Wales, 1928, and may be obtained through any bookseller, or directly from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 1s. 3d.

* * * * *

THE Cambridgeshire Education Committee have now established a Fruit Demonstration Plot on four acres of land at Rampton, situated on a small holdings estate of several hundred acres belonging to the Council in the centre of the fruit-growing district. Steps are being taken to plant one acre of this land with fruit trees, the general lay-out of the plot having been arranged so that two small areas will be devoted entirely to demonstrations of different varieties and stocks, and a larger area to a demonstration of an economical lay-out as a fruit plantation. It is felt that there is considerable need for such a demonstration plot in this area, and that should it be found possible to grow fruit satisfactorily, small holders would come forward with the object of taking up land for fruit growing, while the information derived from the plot should be of general service to the fruit-growing community in the county.

A small plot of half an acre has also been established at Soham in the grounds of the Soham Grammar School.

* * * * *

THE general level of prices of agricultural produce in May was 44 per cent. above that of the base years, 1911-13, as against 46 per cent. in April and 54 per

The Agricultural Index Number cent. a year ago. Prices of live stock, generally, continued to show increases during the month under review, and hay was dearer, but the lower values for potatoes, and the decline from winter to summer prices in the case of milk, were mainly responsible for the fall of 2 points in the general index.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1924 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13					
	1924	1925	1926	1927	1928	1929
January	60	71	58	49	45	45
February	61	69	53	45	43	44
March	57	66	49	43	45	43
April	53	59	52	43	51	46
May	57	57	50	42	54	44
June	56	53	48	41	53	—
July	53	49	48	42	45	—
August	57	54	49	42	44	—
September	61	55	55	43	44	—
October	66	53	48	40	39	—
November	66	54	48	37	41	—
December	65	54	46	38	40	—

Grain.—Wheat at 9s. 11d. and oats at 9s. 9d. per cwt. were both 1d. per cwt. dearer than in April, but as in each instance the increase was appreciably less than in the period April to May, 1911-13, the relative index numbers were 5 points lower at 25 per cent. and 31 per cent. respectively above pre-war. Barley was 2d. per cwt. dearer at an average of 10s. 3d. per cwt., and the index number rose by 2 points to 34 per cent. over the 1911-13 level.

Live Stock.—A further increase in values for fat cattle and pigs was recorded during May, the advance in these classes having been continuous since November last. The index number for fat cattle was one point higher at 32 per cent. above pre-war, while bacon pigs advanced by 8 points to 81 per cent. and pork pigs by 4 points to 78 per cent. Values for store cattle and pigs also were higher at 23 per cent. and 81 per cent., respectively, above 1911-13. As is usual at this time of year, the average for fat sheep showed a fall owing to the inclusion of clipped animals, but, as the decline of $\frac{1}{2}$ d. per lb. was proportionately less than in the corresponding period of the base years, the index number rose by 4 points to 57 per cent. above 1911-13.

Dairy and Poultry Produce.—The chief feature in this section was the large reduction in the average of milk contract prices consequent on the general change from the winter prices ruling in April to summer prices in May, and the index number for milk, at 57 per cent. over pre-war, is 20 points lower on the month but 4 points higher than in May, 1928. A fall occurred also in butter prices and cheese was very slightly cheaper; and in

both instances the index figures were a little lower than a year ago. Eggs were dearer in May at 50 per cent. above pre-war as compared with 35 per cent. and 28 per cent. in the corresponding months of 1928 and 1927. Poultry were appreciably dearer at 65 per cent. above the 1911-13 level.

Other Commodities.—The scarcity of hay, caused by the increased consumption during the severe weather in the first four months of this year, has led to a considerable increase in values for May, the average price per ton being about 8s. more than in April, and the index number, at 22 per cent. above pre-war, is the highest recorded since 1923. Potatoes, however, have been in excess of requirements and the fall in prices has been sufficient to bring the index number to below the pre-war level. In the previous season, on the other hand, a level of 120 per cent. above pre-war was reached. Vegetables, at about double pre-war prices, were a little cheaper in May than in April, and gooseberries averaged about 110 per cent. above 1911-13 as against about 70 per cent. in May, 1928. Wool was unaltered at 59 per cent. dearer than pre-war.

Index numbers of different commodities during recent months and in May, 1927 and 1928, are shown below :—

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1927	1928	1929			
	May	May	Feb.	Mar.	April	May
Wheat	53	40	31	30	30	25
Barley	46	41	28	28	32	34
Oats	27	74	36	36	36	31
Fat cattle	24	48	34	33	31	32
Fat sheep	53	90	56	52	53	57
Bacon pigs	58	42	50	58	73	81
Pork pigs	66	40	60	66	74	78
Dairy cows	24	33	33	30	29	32
Store cattle	23	26	23	22	18	23
Store sheep	38	50	57	56	54	51
Store pigs	99	26	56	57	71	81
Eggs	28	35	68	93	45	50
Poultry	41	51	41	40	38	65
Milk	53	53	70	60	77	57
Butter	42	52	53	54	51	50
Cheese	46	85	74	74	76	81
Potatoes	74	120	29	40	15	—3*
Hay	2	14	4	7	10	22
Wool	31	72	69	60	59	59

* Decrease

WITH the object of improving agriculture in the Punjab, India, the late Sir Ganga Ram, C.I.E., C.V.O., of Lahore, made a generous gift of Rs. 25,000 to the Punjab Government for the endowment of a prize to be awarded for a discovery, or an invention, or a practical method, which would tend to increase the agricultural production of the State on a paying basis. The Punjab, with its many rivers, fertile soil and warm sun, has great agricultural possibilities, and development in this direction is of the utmost importance, since practically the whole population, both urban and rural, depends either directly or indirectly upon the cultivation of the soil. The sum forms a fund, vested in the Treasurer of Charitable Endowment of the Punjab, and is administered by a Managing Committee, to whom the interest accruing is payable. The prize, of the value of Rs. 3,000, known as the Maynard Ganga Ram Prize, is to be awarded every three years, provided that the receipt of a satisfactory and practical proposal is reported to the Managing Committee. Competition for the prize is open to the world, and Government servants are eligible to compete. Although widely advertised in 1926 and 1927, both in India and abroad, the proposed award brought a very poor response. In consequence, it was decided to extend the date for the receipt of applications from January 1 to December 31 this year. Candidates should forward their proposals to reach the Director of Agriculture of the Punjab, Lahore, India, on or before the latter date. The Managing Committee reserves the right of withholding or postponing the prize if no project of sufficient merit is submitted.

* * * * *

IN the September, 1928, issue of this JOURNAL, notice was given of the intention of the Royal Horticultural Society to offer the Jones-Bateman Cup for competition last year. This Cup, which is a valuable silver-gilt replica of the Warwick Vase, was presented to the Society in 1920 by Miss L. Jones-Bateman, of Abergele, to be used for the encouragement of fruit production; and the Society decided, accordingly, to offer the Cup triennially for researches in the growing of hardy fruits, figs, grapes and peaches in the open or under glass. The response to the offer last year was too poor to justify the Cup being awarded, and it is accordingly available for award in 1929.

Candidates desiring to compete should submit accounts of their work by October 31 next. The work dealt with must have been carried out by the candidate in the United Kingdom mainly during the last five years. The Cup will be held for three years by the successful candidate, who will be required to give a bond for its safe return ; and upon its being relinquished at the end of the term, the holder will receive a commemorative gold medal. The holder will be eligible to compete for the Cup on the next or any succeeding occasion.

There will be three Assessors, two of whom will be appointed by the Society and one by the National Farmers' Union, and they will report to the Council of the Society upon the originality and comparative potential value to the fruit-growing industry of the work of the candidates. The Council of the Society will award or withhold the Cup at its discretion. Communications regarding the Competition should be addressed to the Secretary, Royal Horticultural Society, Vincent Square, Westminster, S.W. 1.

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At the North-East Coast Exhibition, which was opened by H.R.H. the Prince of Wales at Newcastle on May 14, the Empire Marketing Board has erected a

Displays of handsome pavilion in which a space has
Home Produce been allocated to the Ministry for the
 display of home produce. The Exhibition

is expected to remain open for six months, and the Ministry, in collaboration with the National Farmers' Union and other organizations, has arranged for commodity displays to be staged in rotation at monthly intervals. During the first period an attractive display of eggs packed under the English and Scottish National Marks was arranged, and in addition a demonstration of egg grading and candling was given. The eggs, which were supplied daily by the Cumberland Poultry Farmers, Ltd., were packed into special cartons, of which over 200 a day were sold on the spot.

The second period is devoted to meat products. The exhibit includes a display of some of the many kinds of bacon and hams produced in this country, while in another corner there are shown nearly all the products made from a pig, including not only edible products, but such things as pigskin purses, brushes, pharmaceutical products, glue, sausage casings, etc. In addition, there is a display of packed meats of all kinds in glasses and tins. Photographs of the egg and meat displays are reproduced herewith.



First period display of National Mark Eggs—showing egg grading machine in foreground.

HOME PRODUCE DISPLAY IN THE EMPIRE MARKETING BOARD PAVILION, NORTH-EAST COAST EXHIBITION, NEWCASTLE.



Second period display: a corner devoted to pig products.

REGULATIONS under the Agricultural Produce (Grading and Marking) Act, 1928, prescribing grade designations and grade designation marks for tomatoes and cucumbers have now been issued in substitution for the Draft and Provisional Regulations made on March 11 last. The text of the new Regulations does not differ in any respect from the text of the draft regulations. Copies of the new Regulations—Agricultural Produce (Grading and Marking) (Tomato and Cucumber) Regulations, 1929 (S. R. & O. 1929, No. 350)—are obtainable through any bookseller or directly from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 1d. net, postage extra.

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THE Poultry Department attached to the County Farm Institute at Cannington, near Bridgwater, has been restricted for some time past owing to the lack of space available for its development. The acquisition of an additional $6\frac{1}{2}$ acres of land last year provided the County Agricultural Committee with the opportunity of setting on foot a scheme for the development of the department, and the Ministry has sanctioned expenditure on the necessary new plant and equipment. The intention is that this Poultry Station shall present an example to the general farmer as to the most profitable method of keeping poultry on a fairly large scale.

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DURING the past year, considerable improvements to the farm buildings at the County Farm at Houghall, Durham, have been undertaken by the County Education Committee, involving the erection of new cow byres, dairy, granary, etc. The erection of these new buildings is now nearing completion, and the Committee have been considering the question of introducing courses of instruction in dairying. There are no facilities at the farm for the accommodation of students, and the financial position precludes the erection of a hostel at present. An offer has been received, however, of the tenancy of a house at Shincliffe,

**Dairying
Instruction
at
Houghall Farm,
Durham**

near by, which seems suitable for the purpose, and a lease of this house is being arranged. The house is being furnished for the accommodation of an assistant dairy instructress, housekeeper, maid and eight or nine students.

* * * * *

Swedish Agricultural Exhibition, 1930.—The 23rd Swedish Agricultural Exhibition is to be held at Stockholm from June 19 to 24 next year. The intention is to make this exhibition a comprehensive display of modern Swedish agricultural practice, and the exhibits, accordingly, will be restricted to animals, products, requisites, machinery, etc., specially selected for their excellence. It is hoped in this way not only to give directive guidance and an incentive to home farmers but, also, to provide a show that will particularly interest visiting agriculturists from other countries. Visitors will have an additional attraction in the finely situated and architecturally interesting Swedish capital itself, with its Town Hall, one of the great European buildings of the present century, as the focal point of the splendid water front. In the Exhibition, dairying will be one of the important features, and dairies will be seen in full operation manufacturing butter, cheese and other milk products. The agricultural machinery section will be very complete, and the application of electrical energy to farming operations will be of particular interest to British farmers. Among other special exhibits may be mentioned a completely-equipped model farm, with all modern technical accessories, pasture paddocks with live stock, etc. The horticultural section will include a number of gardens suitably laid out for private residences, small-holdings and allotments. Fisheries, and the industries connected therewith, are to form another section, exhibiting very fully both the practical and scientific sides of this important industry. It may be added that an extensive display of rural handicrafts and domestic industries, an important feature of Swedish agricultural life, will, for the convenience of visitors, be included in a separate Industrial Art, Handicraft and Domestic Industry Exhibition, which will be in progress at the same time as the Agricultural Show.

* * * * *

Importation of Potatoes into Cyprus.—Revised regulations governing the importation of potatoes into Cyprus prescribe that potatoes may be imported for seed purposes only, and in quantities and from countries specially authorized before-hand by the Director of Agriculture. All potatoes imported must be the produce of crops inspected while growing by an authorized official of the country of origin and found to be not less than 97 per cent. pure. No bag shall contain more than 1 cwt., and every consignment must be accompanied by the following documents:—

(A) A statutory declaration by the shipper in a prescribed form giving details of the consignment, the number of the relevant Purity Certificate and stating that the potatoes were not grown in land infected with Wart Disease, Colorado Beetle or Potato Moth.

(B) Certificates from the Department of Agriculture of the Country of origin to the effect (1) that at a date not more than 30 days before the time of dispatch of the consignment the pests and disease mentioned above have not been known to exist within five miles of the place where the potatoes were grown, and (2) that the consignment has been inspected and found to be in good condition and free from diseases and insect pests.

In addition, consignments will be subject to inspection on arrival, and importers may be required to destroy, disinfect or re-export any consignment found to be unsatisfactory.

* * * * *

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on June 6 and 10, 1929, at 7 Whitehall Place, London, S.W. 1.

The Board received notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates and proceeded to make the following Orders:—

Hertfordshire.—An Order fixing special differential rates of wages for overtime employment of male and female workers on the hay harvest in 1929, the rate in the case of male workers of 21 years of age and over being 10d. per hour and in the case of female workers of 19 years of age and over 7½d. per hour.

Northamptonshire and Soke of Peterborough.—An Order to come into operation on June 17 and to continue in force until October 25, 1930, cancelling the existing minimum and overtime rates and fixing fresh rates in substitution therefor. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 39½ hours in the week in which Christmas Day falls, 48 hours in any other week in winter, 41 hours in the weeks in which Easter Monday and Whit Monday fall, and 50 hours in any other week in summer, with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays, Easter Monday, Whit Monday and Christmas Day. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour with overtime at 7½d. per hour on weekdays and 9d. per hour on Sundays, Easter Monday, Whit Monday and Christmas Day.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

The next meeting of the Board will be held on Tuesday, July 16, 1929.

Enforcement of Minimum Rates of Wages.—During the month ending June 15, legal proceedings were instituted against three employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are at follows:—

County	Court	Fines		Costs		Arrears of wages		No. of workers involved
		£	s. d.	£	s. d.	£	s. d.	
Kent	Cranbrook	6	0 0	5	0 0	40	0 0	3
Leicester	Melton							
	Mowbray	*		0	5 0	18	0 0	1
Cardigan	Tregaron	--		—		—		1
		£6	0 0	£5	5 0	£58	0 0	5

* Dismissed under Probation of Offenders' Act.

* * * * *

Foot-and-Mouth Disease.—After an interval of ten weeks' complete freedom from foot-and-mouth disease in Great Britain, the existence of disease was confirmed on June 5 at Littleton, Winchester, Hants, and the usual restrictions were applied to an area of approximately 15 miles radius round the infected premises. In consequence of a

further outbreak on June 7 at Micheldever, involving Basingstoke Market of June 5, this infected area was extended so as to cover a radius of approximately 10 miles round Basingstoke. A third outbreak, on premises close to those concerned in the initial case, occurred on June 8. The inclusion in the infected area of the Borough of Southampton, in which is situated the only approved landing place for Channel Islands cattle, involved the interruption of the normal trade in cattle from the Channel Islands until June 20, when the area was reduced in extent and the Borough freed from restriction.

Twenty-three outbreaks have been confirmed since January 1 last, located in 9 counties, and involving the slaughter of 559 cattle, 819 sheep, 513 pigs and 4 goats.

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Silton Co-operative Cheese School, Dorset.—The Balance Sheet of the Silton Co-operative Cheese School shows that considerable progress was made during the 1928 cheesemaking season. 13,499 gallons of milk were converted into cheese at a net return of about 1s. per gallon. Eight students received instruction in the school, and, of these, seven have obtained posts on farms in Dorset. The Ministry's cheese-making apparatus, which was on loan, has been purchased by the School, which has now been converted into a limited liability company.

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APPOINTMENTS

THE KING'S BIRTHDAY HONOURS LIST

Knighthood : Mr. James Ralph Jackson, M.R.C.V.S., Chief Veterinary Officer, Ministry of Agriculture and Fisheries.

Mr. Jackson has elected to be styled Sir Ralph Jackson.

Order of the British Empire : *Officer of the Order (O.B.E.)*—Mr. John Claud Fortescue Fryer, M.A., Director of the Plant Pathological Laboratory of the Ministry of Agriculture and Fisheries, Harpenden, Herts. *Member of the Order (M.B.E.)*—Mr. Harry Nash, Deputy Finance Officer, Ministry of Agriculture and Fisheries.

STAFFS OF AGRICULTURAL RESEARCH INSTITUTES

(*Corrections for Lists published in issues of the JOURNAL for January and February, 1929*)

Royal Veterinary College, London

RESEARCH INSTITUTE IN ANIMAL PATHOLOGY

Mr. F. W. Priestley, M.R.C.V.S., has been appointed assistant at the Institute.

London School of Hygiene and Tropical Medicine

INSTITUTE OF AGRICULTURAL PARASITOLOGY

Mr. J. N. Oldham, Ph.D., has been appointed to the staff of the Institute as an additional research assistant.

University of Cambridge

(b) INSTITUTE OF ANIMAL PATHOLOGY

Mr. W. J. Leyshon has now left the Institute and Mr. L. Jordan, M.R.C.V.S., Mr. A. J. Wilsdon, B.Sc., M.R.C.V.S., and Mr. N. S. Barron, M.R.C.V.S., have been appointed to the staff as additional pathologists.

University of Oxford

(a) AGRICULTURAL ECONOMICS RESEARCH INSTITUTE.

Mr. D. Skilbeck, B.A., has been appointed assistant at the Institute.

University College of Wales**WELSH PLANT BREEDING STATION**

Mr. M. G. Jones has resigned his appointment.

Rothamsted Experimental Station, Harpenden, Herts

Mr. H. C. F. Newton, B.Sc., has been appointed to the Station as an additional assistant entomologist.

SPECIALIST ADVISORY STAFFS

(Corrections for List published in the issue of the JOURNAL for October, 1928)

3. MIDLAND PROVINCE (Derby, Leicester, Lincoln (Lindsey), Nottingham, Rutland)

Midland Agricultural and Dairy College, Sutton Bonington, Loughborough

Provision has now been made for advisory work in dairy bacteriology, and Mr. A. Rowlands, B.Sc., has been appointed assistant in Dairy Bacteriology.

10. WEST MIDLAND PROVINCE (Salop, Stafford, Warwick)

Harper Adams Agricultural College, Newport, Salop

Mr. E. E. Edwards, M.Sc., has been appointed to the vacant post of Entomologist.

**COUNTY AGRICULTURAL EDUCATION STAFFS :
ENGLAND**

Derbyshire : The post of Instructor in Poultry-Keeping held by Mr. G. W. Brindley on a part-time basis has now been made a full-time appointment.

Nottinghamshire : Mr. W. M. Gair has been appointed Instructor in Small Live Stock, *vice* Mr. H. D. Day.

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NOTICES OF BOOKS

Minerals in Pastures and their Relation to Animal Nutrition.—By J. B. Orr, D.S.O., M.C., M.A., D.Sc., M.D. ; with the assistance of Helen Scherbatoff. Pp. xv+150. (London : H. K. Lewis & Co., Ltd. 1929. Price 10s. 6d. net.)

This valuable treatise is primarily the outcome of the deliberations of a sub-committee appointed in 1926 by the Civil Research Committee of the Cabinet to consider and report on the relationship between the mineral content of pastures and their nutritive value. From the initial inquiries instituted by this sub-committee, it was evident that malnutrition in cattle and sheep arising from deficiency of minerals in grass was widespread in the pastoral areas of the Empire, and that the subject, which was of great economic significance, warranted close and systematic investigation. A report to this effect was duly forwarded to the Civil Research Committee, on whose further recommendation grants were made by the Empire Marketing Board in aid of a comprehensive scheme of investigations into the mineral aspects of pastures within the Empire. A twofold scheme of work was adopted, actual investigations in selected grassland areas being supplemented by a detailed search of the literature dealing with every phase of the subject. Major Elliot states in the preface to the volume : "At the request of the sub-committee, the information so far obtained has been brought together by Dr. Orr, in the present review, with the

object of having it circulated to various officials and research workers throughout the Empire who are interested in the subject."

Dr. Orr was eminently fitted for this task, since in recent years he has had opportunities of meeting most of the workers within the Empire who are carrying on research on the mineral content of pastures. The reader will admire his comprehensive and lucid treatment of the subject. A large mass of information, scattered for the most part in numerous scientific journals inaccessible to the ordinary reader, has been collected and welded together in a systematic and an attractive manner. Beginning with an explanation of the economic importance of grassland, the author passes on to trace the development of scientific methods for investigating the problems of pastures. This is followed by a minute survey of the results of many investigations into the mineral composition of both good and poor pastures in the British Isles and in various parts of the world. The factors which affect the mineral content of pastures are also considered in the light of present knowledge. The author then proceeds to deal with various forms of disease which are attributable to deficiency of minerals in pasture herbage. The deficiency diseases of grazing animals in Europe, Africa, Australasia, America and Asia are described in separate chapters, and the results of investigations into the causes of such diseases are summarized and critically discussed. A further chapter treats of the prevention of deficiency diseases in pasturing stock, either by the direct administration to the animal of the deficient minerals or by the enrichment of the pastures through the application of mineral fertilizers to the soil. It is shown that the prevention of disease by these measures leads also to an increased rate of growth in animals and to an increased production in adult females.

The book may be recommended primarily as a guide and stimulus to research workers in the domain of pastoral problems. To such readers, the excellent bibliographies at the ends of the chapters will be of immense value. Dr. Orr's work, however, should make a much wider appeal than this. It should be read with interest and profit by all who are interested in grassland husbandry, veterinary practice, or in the sciences of biochemistry and animal nutrition.

The British Goat Society's Year Book for 1929. Pp. 204. (Compiled and issued by the Hon. Sec.:—Thomas W. Palmer, 10, Lloyd's Avenue, E.C. 3. Price 1s. 6d.)

The ninth issue of this useful annual is prefaced by a letter from Mr. H. S. Holmes Pegler, who founded the British Goat Society just half a century ago, acted as its Honorary Secretary until 1917, and has been elected President for the current year. His brief summary of the work of the past fifty years shows how much has been accomplished during that period towards the improvement of the goat in size, in general appearance, and, above all, in capacity for milk production. The technical problems of the industry receive due attention from recognized authorities on their subjects. For instance, Mr. F. E. Corrie deals with the feeding of potassium iodide to the breeding goat; Dr. W. K. Bell shows the value of the calcium content of goats' milk, especially to the convalescent; Messrs. J. C. Urquhart and F. Knowles offer a reason for the high digestibility which makes goats' milk so suitable for infants and invalids. An interesting chapter on "Breeding for Milk" by Mr. A. D. Buchanan Smith, of the Animal Breeding Research Department at Edinburgh, points the way to further possibilities in the matter of milk production by goats. In this connexion it may be mentioned that during the year ended October 1, 1928, according to official records, one goat yielded 4,343 lb. 11 oz. in 315½ days, another 4,059 lb. 10 oz. in 361 days,

while a third gave 4,056 lb. 10 oz. in 323 days. Dr. S. A. Asdell writes on "The Duration of Pregnancy in the Goat," a subject of special interest to stockbreeders, and Dr. R. T. Leiper, Director of the Institute of Agricultural Parasitology, deals with the internal parasites of goats. As Director of the forthcoming World's Poultry Congress, Mr. P. A. Francis appeals to British goat-keepers to avail themselves of the opportunity which it affords to organize a display of good quality goats. The numerous illustrations, articles, statistical tables and other useful data combine to make this Year Book an attractive work of reference for the goatkeeper.

Weather.—By E. E. Free and Travis Hoke. Pp. 328. (London : Constable & Co., Ltd. 1929. Price 14s. net.)

The authors set out to answer the many questions raised by the man in the street as to the why and wherefore of the weather. They have covered the ground systematically and comprehensively; the result is a readable and instructive volume that does not fog the lay reader with scientific data. The weather under consideration is mainly that enjoyed in the U.S.A. This does not, however, detract from the value of the book to readers in this country. The laws governing the weather are universal in their application; the difficulty in forecasting the weather is apparently that of giving every factor its proper value at the moment.

In view of the fact that agriculture is the world's basic industry and that most affected by the vagaries of the weather, it is a little surprising that out of 328 pages only 8 (chapter 24) are specifically devoted to facts for farmers. Attention is called to the effect of the weather on the health and growth of plant life and to the value of warnings issued to the farmer of the approach of weather injurious to crops or stock, but no reference is made to the possibilities of utilizing, for the future guidance of the farmer, the accumulated stores of weather knowledge in connexion with crop forecasts or of correlating the weather with the incidence of disease or insect pests, or the health and fecundity of farm animals.

The book can be confidently recommended to all whose interest in the weather extends beyond tapping the barometer when a fine day is desired. It is full of practical, dramatic and spectacular facts about a little-studied subject.

Der Feldversuch in der Praxis (Field Experiments in Practice).—By Dr. E. Möller-Arnold and Dr. E. Feichtinger. Pp. xii + 329. (Vienna : Julius Springer. 1929. Price 12.60 Reichsmarks.)

This book claims in its preface to be for the use of men actually engaged in field-experimental work : to be neither a scientific treatise nor a polemic on disputed matters. It is divided into two sections : first, a theoretical section, dealing with the calculation of experimental errors and with the elimination of systematic soil-errors; and second, and "by far the most important," a section treating with actual practical details.

The pages introducing the concepts of a normal population and of a standard deviation are lucidly written. Confusion is likely to be caused, however, by the failure to draw a clear distinction between population parameters and *estimates* of these parameters obtained from samples.

The use of the approximate relation due to Peters, quoted on p. 19, is not to be recommended. With a calculating machine or good mathematical tables the exact quantities can be obtained with little more trouble than is required for such doubtfully useful approximations.

Pages 26-82 afford a convenient summary of usual Continental practice in the laying-out of field experiments. The methods described in detail are without exception vitiated by involving a systematic alternation of plots bearing the varieties or fertilizers to be tested, so that in no case is it possible to obtain a valid estimate of error. It should by now be realized that, in absence of a *a priori* knowledge of the distribution of soil-fertility, no valid estimate of experimental error is obtainable except by a random arrangement of plots. The grosser elements of soil heterogeneity may be eliminated by careful restriction of the randomization, but the calculation of the error must rest on the assumption that plots similarly treated are in no relevant manner distinguished from plots differently treated.

Among certain English and American methods described briefly "for the sake of completeness," is mentioned the Latin square arrangement devised by R. A. Fisher. The method is grossly misrepresented. It is not confined, as is implied, to the testing of five treatments in five-fold replication, but may be used for any number from three upwards; nor is the method of calculation laborious. The writers are further in error in that they have omitted the variation due to treatment (or varietal) differences in their analysis of the total variation. This is unfortunate, since the test of significance (based on exact distributions) depends on the comparison of this fraction with that due to unknown or uncontrolled causes. The most serious omission, however, is failure to point out that the arrangement is selected *at random* from all possible arrangements. It is this fact which causes it to be the only method amongst all those described in which a valid estimate of error can be made. This fact, too, makes it essentially different from the method of Knut Vik, in which the arrangement of plots is systematic, and with which only five treatments or varieties can conveniently be compared.

In their quest of completeness the writers should have referred to the more generally useful "Randomized Blocks" method, again due to R. A. Fisher. Here, too, the arrangement permits of a valid estimate of error, as well as of the elimination of a great deal of the effect of soil heterogeneity. Like the Latin square arrangement, it economizes in the number of "control" plots as compared with most of the methods described.

Pages 79-81, in which are discussed the relative advantages of increasing the area of the individual plot and of increasing the number of replications, contain important matter clearly explained.

The second section of the book treats in considerable detail with the more purely practical aspects of field experimentation. It deals with manurial and varietal tests on all the standard crops; with experiments on methods of drilling and cultivation; and finally with various methods of soil and crop analysis. This part should be most valuable for those actually engaged in field-work. It is marred by much too lengthy a description of the analytic methods of Neubauer and Mitscherlich. The writers point out that the methods may not be "theoretically tenable," but surely it is sufficient for the field-worker, whose guide the book purports to be, that they are not even justified by their results. It has been abundantly demonstrated that the equations of Mitscherlich are of no value for the estimation of the availability of the reserves of plant foods in ordinary soils. A method equally empirical, but with the saving grace that it yields results which agree with observation, has recently been described by B. Balmukand (Jour. Agric. Sci., XVIII, 1928), and this might with advantage have been mentioned.

In justice to the authors it can be said that the part they have deemed most important is best done. A better acquaintance with the English literature would have obviated the unfortunate omissions of the remainder of the book.

Poultry Trade Secrets.—By G. R. Scott. Pp. xi+111. (London : Crosby, Lockwood & Son, 1929. Price 2s. 6d. net.)

As its name implies, this book is not a poultry manual in the ordinary sense. Its purpose is to make known what the author describes as "trade secrets" or the lesser known traditional practice on poultry matters, directed for the most part to the preparation of birds for exhibition. The book includes not only a number of "tips" for the final grooming of the bird before it goes on to the show bench, but deals also with feeding and roosting as bearing on the exhibiting of poultry. To the fancier, and to those who aim at exhibiting their stock at shows, this little book will be found of considerable interest.

Corn and Corn Growing.—By Henry A. Wallace and Earl N. Bressman. Third edition. Completely revised. (London : Chapman & Hall, Ltd., 1928. Price 12s. 6d. net.)

In this new edition, the authors have incorporated the experience gained in America since the previous edition was issued. It, however, deals mainly with American conditions of cultivation in what is known as the Corn (Maize) Belt. The chapters on the cultivation of the crop for fodder and silage, varieties, and cost of production will be those of most interest to the British farmer, and will be of service in amplification of the information contained in the Ministry's Leaflet No. 73 on the cultivation of maize for fodder.

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ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

Miller, J.—*Botanicum Officinale ; or a Compendious Herbal ; giving an Account of all such Plants as are now used in the Practice of Physick, with their Descriptions and Virtues.* (466 pp.) London : Bell, Senex, Taylor and Osborn, 1722. [63.348.]

Aikin, A.—*The Natural History of the Year : Being an enlargement of Dr. Aikin's Calendar of Nature.* (195 pp.) London : J. Johnson, 1798. [59.]

Hall, Sir A. D.—*Fertilizers and Manures* (406 pp. + 8 pl.) (Third Edition) London : John Murray, 1929, 8s. [63.16.]

Recent Changes in Systems of Husbandry in England : Being the Report of a Conference held at Rothamsted on November 27, 1928, under the chairmanship of Professor H. E. Armstrong. (Rothamsted Conferences VIII) (56 pp.) London : Ernest Benn, 1929, 2s. 6d. [63(42) ; 63.191.]

The Hertfordshire Agricultural Situation : Can it be Improved ? Being the Report of a Conference held at Rothamsted on January 11, 1929, under the chairmanship of Sir John Russell. (Rothamsted Conferences IX) (47 pp.) London : Ernest Benn, 1929, 2s. [63(42).]

Empire Marketing Board.—E.M.B. 16. *Report on Development of Agriculture in British Honduras, by H. C. Sampson.* (66 pp. and map.) London : H.M. Stationery Office, 1929, 1s. 6d. [63(8).]

Tanganyika Territory : Report of the Director of Agriculture for the year ending March 31, 1928. (58 pp.) Dar es Salaam, 1929, Shs. 2/50.

- Ashby, M. K.*—The Country School: Its Practice and Problems. (276 pp.) Oxford University Press; London: Humphrey Milford, 1929, 6s. [372.]
- Hawk, W.*—Agricultural Experiments in Cornwall. (251 pp.) Issued with the Authority of the Cornwall County Council, Truro, 1929. [37(42).]
- Ashbrook, F. G.*—Fur-Farming for Profit. (300 pp.) New York and London: Macmillan Co., 1928, \$4.00. [63.69; 63.762.]
- Haines, A. H.*—Surveying for Agricultural Students, Land Agents and Farmers. (210 pp.) (New Edition.) London: Longmans, Green, 1929, 12s. 6d. [52.]
- Bailey, E. H. S. and Bailey, H. S.*—Food Products: Their Source, Chemistry and Use. (563 pp.) (Third Revised Edition.) Philadelphia: Blakeston, Son & Co., 1928. [338.9; 543.1; 614.31; 612.39; 664.]
- Imperial Economic Committee.* Eleventh Report: A Survey of the Trade in Agricultural Machinery. (72 pp.) London: H.M. Stationery Office, 1929, 6d. [63.17.]
- Theobald, Sir H. S.*—The Law of Land. (424 pp.) (Second Edition.) London: St. Catherine Press, 1929, 21s. [347.]
- Wardle, R. A.*—The Principles of Applied Zoology. (427 pp.) London: Longmans, Green, 1929, 21s. [59.16; 619.]
- Elton, C.*—Animal Ecology. With an Introduction by *Julian S. Huxley*. (207 pp. + 8 pl.) London: Sidgwick & Jackson, 1927, 10s. 6d. [58.3; 59.]

Field Crops

- Aberystwyth, University College of Wales.*—Leaflet Series S. No. 1: New Varieties and Strains from the Welsh Plant Breeding Station. No. 1: Pure Lines of Hen Gymro Wheat. (16 pp. + 6 pl.) Aberystwyth, 1929, 1s. [63.1952; 63.311.]
- Wallace, H. A. and Bressman, E. N.*—Corn and Corn Growing. (371 pp.) (Third Edition.) New York: John Wiley; London: Chapman & Hall, 1928, 12s. 6d. [62.315.]
- U.S. Department of Agriculture.*—Farmers' Bulletin, No. 1539: High-grade Alfalfa Hay: Methods of Producing, Baling, and Loading for Market. (26 pp.) Washington, 1929. [63.1982; 63.33.]
- U.S. Department of Agriculture.* Farmers' Bulletin No. 1555: Peppermint and Spearmint as Farm Crops. (26 pp.) Washington, 1929. [63.345.]

Horticulture

- Harrison, C.*—A Treatise on the Culture and Management of Fruit Trees. (356 pp.) (Second Edition.) London, 1825. [63.41.]
- Sanders, T. W.*—Roses and their Cultivation. (202 pp. + 52 pl.) (Thirteenth Edition.) London: W. H. and L. Collingridge, 1929, 7s. 6d. [63.522.]
- Unwin, C. W. J.*—Sweet Peas: Their History, Development, Culture. (192 pp. + 19 pl.) (Second Edition.) Cambridge: Heffer & Sons, 1929, 2s. 6d. [63.522.]
- Sanders, T. W.*—The Amateur's Greenhouse: A Complete Guide to the Management of Greenhouses. (442 pp. + 44 pl.) (Seventh Edition.) London: W. H. & L. Collingridge, 1929, 7s. 6d. [63.5-19.]
- Livingston, A. E.*—Your Flower Garden and the Things that Matter. (208 pp. + 17 pl.) London: Crosby, Lockwood, 1929, 5s. [63.5; 63.522.]

Plant Pests and Diseases

Robinson, D. H. and Jary, S. G.—Agricultural Entomology. (303 pp.) London: Duckworth & Co., 1929, 15s. [63.27; 63.29.]

Australia: Council for Scientific and Industrial Research.—Bulletin No. 41: Studies Concerning the so-called Bitter Pit of Apples in Australia; with special reference to the variety "Cleopatra." (101 pp.) Melbourne, 1929. [63.21; 63.41.]

U.S. Department of Agriculture.—Farmers' Bulletin No. 1588: Frost and the Prevention of Frost Damage. (62 pp.) Washington, 1929. [63.21.]

Live Stock and Feeding

Davis, K. C.—Livestock Enterprises. (492 pp.) Philadelphia and London: J. B. Lippincott Co., 1929, 10s. 6d. [63.6(73); 63.60.]

Sampson, A. W.—Livestock Husbandry on Range and Pasture. (411 pp.) New York: John Wiley; London: Chapman & Hall, 1929, 22s. 6d. [63.6; 63.60; 63.603.]

Sanders, A. H.—A History of Aberdeen-Angus Cattle; with Particular Reference to their Introduction, Distribution and Rise to Popularity in the Field of Fine Beef Production in North America. (1042 pp. + 240 illustrations.) Chicago: New Breeder's Gazette, 1928. [63.602; 63.62.]

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THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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NOTES FOR THE MONTH

MANY readers of this JOURNAL are doubtless aware that in parts of Yorkshire, Lincolnshire and certain other districts, outgoing tenants are entitled, by the terms of their tenancy agreements or by custom, to away-going crops or, alternatively, to the value of the away-going crops grown on land after clovers, roots and other fallow crops, less the cost of harvesting and other expenditure to be incurred by the new occupier. Tenant right valuations in other parts of the country are usually based on the costs of seeds, manure and labour applied to the crops up to the date of the outgoing tenant quitting the holding, the incoming tenant paying for this valuation and continuing subsequent operations for his own benefit. As a rule, tenancy agreements in which away-going crop valuation rights are granted specify not merely the crops after which the tenant can claim an away-going crop valuation, but also the maximum area (usually one-third or one-quarter of the total arable land of the farm) in respect of which an away-going valuation will be granted.

A few months ago, the National Farmers' Union directed the attention of the Ministry to the case of an outgoing tenant in Yorkshire who had included in his claim for tenant right an away-going crop valuation for a cereal crop on land which had in the previous year grown sugar beet. As the relative clause in the tenancy agreement made no provision for a claim for an away-going crop valuation following sugar beet, the tenant's claim was rejected. The National Farmers' Union pointed out to the Ministry that, while they did not wish to make any representations with regard to the individual case, they thought the matter was of sufficient importance, from the point of view of the development of the sugar beet industry in this country, to justify further investigation.

The Ministry accordingly inquired into the facts of the particular case and has subsequently discussed the matter in its more general aspects with representatives of the National

Farmers' Union, the Land Agents' Society and other persons interested.

It appears that, in the case cited, the tenant was entitled to claim an away-going crop valuation not exceeding a specified acreage, to be taken after "fallow, potatoes, rape, turnips or mangolds or from seeds or clover." The tenancy agreement contained no phrase such as "other roots" which could be interpreted as covering sugar beet. The tenant in question realized that he had run a risk in claiming an away-going crop valuation following sugar beet and stated that he had no desire to criticise the landlord's decision not to recognize such claim.

The Ministry thinks it desirable to advise farmers whose tenancy agreements entitle them to an away-going crop valuation, that they should examine the terms of their tenancy agreements and satisfy themselves before sowing a crop of sugar beet in the last year of their tenancy, that they are entitled to claim an away-going valuation on the succeeding crop. Where the terms of his tenancy agreement do not include sugar beet, a farmer is running a serious risk of not being allowed an away-going valuation on a crop following sugar beet. In such circumstances, a farmer would be well-advised to approach his landlord previous to the last year of the tenancy and ask that his tenancy agreement be endorsed so as to bring sugar beet within the scope of the away-going crop clause. It will be observed that, in the case to which the Ministry's attention was called, the tenant was entitled to an away-going valuation on a crop following either mangolds or potatoes. If sugar beet had been included among the crops named in the clause or if the agreement had subsequently been endorsed so as to include sugar beet with the other crops named, the tenant would have been in order in claiming an away-going valuation for the following cereal crop. In this event, it would have been left to the tenant right valuers (or, failing agreement, to a single arbitrator) to determine whether, in the circumstances of the particular case, the cereal crop was to be regarded as grown after mangolds sold off the farm or after potatoes.

* * * * *

THE following particulars regarding the manufacture of Blue Vinny cheese have been supplied by Mr. T. R. Ferris, the Director of Agriculture for Dorset, as the result of some experiments carried out by him and Miss H. M. Balch, the County Dairying Instructress, at various centres

Blue Vinny Cheese

in the county. Blue Vinny is an old-established cheese of great reputation, the manufacture of which is almost confined to Dorset. It differs from many other varieties of cheese chiefly by the fact that it is the only hard-pressed cheese made from skimmed milk. Science has taken little part in its manufacture, the methods adopted being, as a general rule, handed down from generation to generation, the makers relying on their sense of smell and of taste in turning out the finished article. In a large number of cases, the maker of Blue Vinny does not even use a thermometer. As may be expected, the quality of the cheese produced has been anything but uniform. In some instances, quite excellent cheese has been obtained, but, in the majority of cases, very inferior cheeses, lacking in uniformity, have resulted, of which only a comparatively small percentage have turned blue.

With the object of obtaining definite data for guidance in the making of this cheese, some experiments were carried out in the west of the county, where most of the Blue Vinny makers reside. A record was kept of the essential details in the manufacture of each cheese, and the development of the curd to the finished article was carefully watched for the purpose of determining points in regard to temperature, acidity, pressing and other incidentals. Subsequently, it was determined to try out the data collected by further investigation at the Silton Co-operative Cheese School, particularly because, as far as was known, no Blue Vinny cheese had ever been made in that district, and it was considered by cheesemakers impossible to make this variety of cheese in any part of the county other than that in which it had, normally, been made in the past. Accordingly, a certain small quantity of the milk received at the School was utilized for making Blue Vinny; and, as a result of the experiments, the following method was found to give the most satisfactory result.

The milk was strained into a cooler or some shallow vessel and skimmed twice. After skimming, it was found that from 0.8 to 1 per cent. of butter fat remained in the milk. Unless the weather was too hot, three meals of milk were utilized in connexion with each making, the object being to allow for the natural development of acidity in the milk, as the use of starter tends to produce too dry a curd. The acidity of the milk at the time of rennetting was from .27 to .3 per cent. The best temperature of milk at which to rennet was found to be from 74° to 80° F. In cool weather, and with richer milk, the higher temperature for rennetting was required. The amount of

rennet used was 1 dram to 5 or 6 gallons of milk. The time taken for the curd to coagulate was from 60-80 minutes. When coagulated, the curd was cut into small pieces about the size of horse beans, this being done either with American knives or by a breaker, the latter being more generally used by the Blue Vinny makers. The curd was then left for 10 minutes, stirred for 10 minutes and left for $1\frac{1}{2}$ to 2 hours until it had, to a large extent, sunk to the bottom of the tub, and the acidity had developed to about 3 per cent. in the whey. For the manufacture of this cheese, no scalding is required.

After drawing off the whey, the curd was piled in the centre of the tub and left for a period of 20 to 30 minutes, the length of the period varying according to the firmness of the curd. With a soft curd, the longer time was necessary. The curd was then cut into 6-inch cubes and turned at intervals varying with the rate at which the acidity was developing. When an acidity of from .9 to .95 had developed and the curd felt firm and dry, it was broken up by hand into small pieces. If a curd mill is used for the breaking, it is advisable to have the teeth closely set. Salt was added at the rate of $1\frac{1}{2}$ lb. to every 50 gallons of skim milk used. The curd was then placed in wooden moulds lined with a coarse cheese cloth, and the moulds placed in the press, screw pressure only being applied for a period of four hours. The cheeses were then turned, rubbed with salt and returned to the press, a pressure of 6 cwt. being applied. They remained in the press for a period of 12 hours and were then turned again and subjected to the same pressure for a further 12 hours, after which they were removed to the ripening room. In the ripening room, they were turned daily for the first six weeks after making, and then every alternate day until ripe.

The length of time taken for the blue mould to develop varies, but all the cheeses made during these experiments became blue in from four to five months. It is customary to make the Blue Vinny cheese in flat shapes weighing from 14 to 18 lb. when ripe. The advantages in the manufacture of this cheese are that the greater value of the milk is utilized in the production of butter, and that it is economical to make so far as utensils and fuel are concerned. The principal utensils required comprise a round tub with raised centre, a breaker, wooden moulds and a press. The time spent in making the butter and the Blue Vinny is rather more than that needed to make cheddar cheese, and, comparatively, the cost of labour would, therefore, be slightly higher.

From the records kept during the experiments, two are given under. It will be noted that one related to the month of October, the other to the month of May.

	(1) October 9	(2) May 8
Temperature of dairy	60° F.	64° F.
Quantity of milk	38 gal.	20 gal.
Temperature at rennetting	76° F.	74° F.
Acidity at rennetting	·3 per cent.	·28 per cent.
Amount of rennet	7½ drams	3½ drams
Time rennetted	8.20 a.m.	9.30 a.m.
Time cut	9.30 a.m.	10.40 a.m.
Time occupied in cutting & stirring	15 minutes	20 minutes
Acidity at cutting	·23 per cent.	·215 per cent.
Time whey drawn	11.55 a.m.	12.50 p.m.
Acidity at drawing whey	·31 per cent.	·3 per cent.
Acidity after drawing whey	·38 per cent.	·36 per cent.
Curd piled in tub	12.25 p.m.	1.20 p.m.
Acidity after piling	·5 per cent.	·48 per cent.
Turnings	15, 20 & 10 min.	15, 15 & 15 min.
Acidity of curd at grinding	·93 per cent.	·85 per cent.
Weight of curd	42 lb.	22 lb.
Weight of salt	12 oz.	7 oz.
Time when curd vatted	2.45 p.m.	2.30 p.m.
Acidity of whey from press	·95 per cent.	·9 per cent.
Weight of cheese when ripe	17 lb.	10 lb.
Butter-fat content	·8 per cent.	1.0 per cent.

* * * * *

THE Report on "Markets and Fairs in England and Wales—Part IV. Eastern and Southern Markets"—is the latest

addition to the Economic Series of the

Markets and Fairs Ministry of Agriculture and Fisheries*.

in England and Part I. (Economic Series No. 13) was a

Wales

general review of market conditions in

the country, Parts II. and III. (Economic Series Nos. 14 and 19) were surveys of the markets and fairs of the Midland and Northern Counties respectively. The present Report (Economic Series No. 23) deals with the 670 markets and 268 fairs of the ten counties south and south-west of the Thames and of Buckinghamshire, Hertfordshire, Middlesex, Essex, Suffolk and Norfolk. The London and Welsh markets are reserved for a later report.

The Report just issued is on similar lines to those of its predecessors and is divided into three main sections. The first of these deals with the eastern and southern markets as a whole. A general summary is made of the markets according to the commodities sold, and attention is drawn to

* Published by His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price 6d.

distinctive features. Instances of market tolls, rents and stallages are quoted, detailed information regarding which can be obtained on application to the Ministry. The section also contains a chapter on fairs which, in the south, still continue to fill an important place in the marketing of store sheep.

Section II. reviews the markets of each county in relation to agricultural production. Brief notes are given on the markets in 46 centres which present features of special interest.

Section III. is a detailed description of the markets in 18 centres; these have been singled out for special notice as being among the most important.

The Appendices form a complete guide to the markets and fairs of the area. They include a list of all markets, arranged county by county, with particulars of ownership and such details as the market days, commodities sold and methods of sale, a list of all agricultural fairs with their dates and type, and a statement of the numbers of livestock sold at each fair or market.

The report is mainly descriptive, the information which it supplies offering a basis for judging the adequacy and efficiency of the markets in relation to their environment. Apart from its bearing on the general problem of the marketing of agricultural produce, the report should be of value to market owners and members of market committees, as well as to auctioneers, producers and distributors of agricultural produce generally.

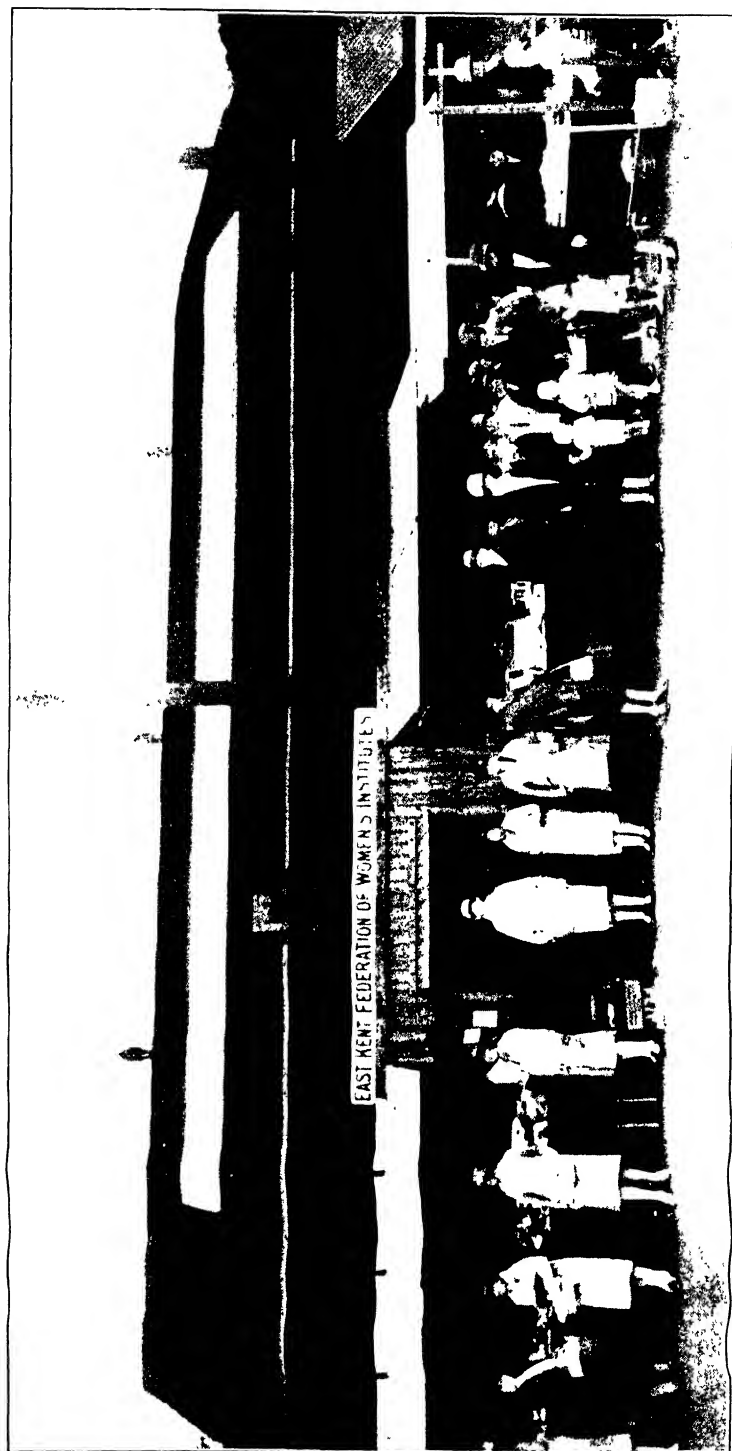
With the aid of a grant from the Empire Marketing Board, the Report is issued at the nominal price of 6d.

* * * * *

MARKET stalls for the sale of home produce have been organized by the Federation of Women's Institutes in a number of counties, the work done in connexion with the stalls being voluntary. Considerable progress is being made with this movement, which appears likely to extend widely and prove very successful. Through the courtesy of Mr. G. H.

Garrad, Agricultural Organizer for Kent, the Ministry has received from Mrs. Miles, Potters Corner Woods, Ashford, an interesting note on the Women's Institute Market Stall in Ashford Market.

This stall was opened on February 7, 1928, to act as



Women's Institute Stall at Ashford Market, Kent. This view shows the entire stall, 40 ft. long, including a new extension on the right ; also framework of unfinished addition in foreground.

"middleman" for the sale of garden produce, home-made bread, cakes and preserves made by members of the Women's Institutes in East Kent.

The stall was organized by Mrs. Miles and a small committee on the following lines. A site in the Ashford Livestock Market was rented. A sum of £25 was advanced by the East Kent Federation of Women's Institutes and a further £25 was subscribed by 25 Institutes who desired to become members. A suitable hut was then erected at a cost of £40, £25 being paid down and the remainder standing over at 5 per cent. interest per annum. The remainder of the capital was kept for working expenses such as equipment for the hut, scales, books, bags, insurance, etc.

The Institute members were then notified of the conditions of sale, of the simple methods of invoicing goods, and of the date of opening. The stall opened with a staff of four voluntary helpers and a paid accountant, and proved an immediate success, beginning with a turnover of £8 for that day. Since then the Stall has been open weekly on every Tuesday (Market Day) and has done steadily increasing business, so that the premises have had to be enlarged to more than double the original size, and the working staff increased to twelve. The weekly turnover during the summer is now frequently over £40. The turnover for the year ending January 31, 1929, was £1,423 17s. 10½d., of which £1,305 17s. 11½d. was paid to producers, the remainder being commission of 1d. in the shilling to cover expenses, which amounted to £93 15s. 7½d., independent of buildings and equipment. The accounts were officially audited at the end of the year.

In the fifteen months during which the stall has been running it has become quite evident that it has filled a real need. Further, it has stimulated both the demand for and supply of home-made bread, preserves, etc., and has proved an efficient means of putting before the public a quantity of high quality produce which could otherwise have been marketed only with difficulty. Since the majority of the labour is voluntary it has always been possible to offer the produce at a price at which it sells readily and yet is profitable to the producer.

Numerous inquiries have been received from counties in which it is hoped that similar stalls may be started. To those who are thinking of organizing such stalls, the question of an efficient accountant and the careful elimination of all but high quality produce cannot be over-emphasized.

THE third annual competition in the judging of livestock, open to students of Farm Institutes in England and Wales, was held on June 6 last on the farm of **Farm Institute** Mr. H. Turner, at Puttenham, near **Livestock** Tring, Herts. These competitions are **Judging** managed by a Committee representative of the National Farmers' Union, the **Competition** Royal Agricultural Society of England, the County Councils' Association and the Ministry. The judges are appointed by the Ministry and the Institutes compete for a perpetual challenge cup provided by the National Farmers' Union.

The five classes of stock judged in the 1929 competition were Shorthorn dairy cows in milk, Shire horses, Crossbred pigs, Kent-Southdown wether tegs and Rhode Island Red poultry. Before the competition commenced the expert judges placed the stock in order of merit and their decisions served as standards for arriving at the results. Competitors were advised to direct their attention to commercial value rather than to points of breeding.

Five of the seven Institutes which participated in the 1928 competition again entered teams; these were the Cheshire School of Agriculture, Llysfasi Farm Institute (Denbighshire), Monmouthshire Agricultural Institute, Moulton Farm Institute (Northants) and the Rodbaston Farm Institute (Staffs.). The Chadacre Agricultural Institute (Suffolk) competed for the first time, whilst the Hampshire Farm Institute, which competed in 1927 but did not participate in 1928, made its reappearance. Each team consisted of three competitors.

The Staffordshire Institute, which took second place in the first competition in 1927, succeeded in winning the cup, the second and third places being taken by the Hampshire and Cheshire teams respectively.

The competition was successful, the farm being eminently suitable for the purpose. Mr. John Garton, President of the National Farmers' Union, attended and presented the cup to the winning team. Mr. Edward Lawrence, Chairman of the Education Committee of the National Farmers' Union, and several local members of the Union testified by their presence to the interest evinced by agriculturists in the educational value of these contests.

A useful feature of the day's proceedings was a demonstration by Mr. Turner of cutting short grass and drying it

to form a cake substitute. Mr. Turner's Hereford cows and Mr. W. B. Southernwood's Western and Ryeland sheep were also on view.

* * * * *

THE expansion of dairy farming in recent years, coinciding with the more intensive scientific study of dairying problems and an awakened public interest in clean milk production, has, not unnaturally, stimulated a demand for skilled assistance on the dairy side of agriculture; and young people have been attracted in increasing number to the dairy schools for a course of study that would fit them for employment in this direction. Some of the agricultural education authorities concerned have felt, however, that the benefits of such training might be better maintained if some means existed for keeping in touch with past students—that some organization, with a social as well as an educational aspect, was required to enable them, for mutual benefit, to keep in touch both with the county staff and with each other. Such an organization is now in existence in three counties—Gloucestershire, Wiltshire and Worcester-shire—and of that recently inaugurated in Wilts., Mr. W. T. Price, the County Agricultural Organizer, has supplied the following particulars.

The Association of Wiltshire Dairy Students owes its inception to a visit paid by a party of Wilts. dairy students, farmers, etc., interested in the proposed movement, to the Royal Agricultural College at Cirencester, where they met Mr. G. H. Hollingworth, the Gloucestershire County Organizer, and Miss Colnett, the County Dairying Instructress, who at a conference held on the evening of this visit, outlined the working of the Association formed in their county. As a result of the interesting discussion at this meeting, it was unanimously resolved to form a similar Association in Wiltshire, with one point of difference—that male students should be eligible for membership.

The appointment of officers first engaged attention and, for the important post of President, the Association was fortunate in obtaining the services of Mrs. Robert Fuller, who has always taken an active interest in agricultural education generally, and dairying in particular. An Hon. Secretary was appointed and a Committee elected, members from the various districts of the county being chosen for this so that they might act as local secretaries within their own areas. The

Agricultural Organizer is at present acting as Chairman of the Association, and Mrs. I. M. Bull, the County Dairy Instructress, as Hon. Treasurer and Technical Adviser. The only other officer is an Hon. Editor. The aims and objects of the Association may be summarized briefly as follows :—

- (1) (a) To enable dairy students to keep in touch with one another and with the Department of Agricultural Education of the Wilts County Council, so as to maintain a live interest in the educational and commercial aspects of dairying ; and
 (b) To assist all students (by the establishment of a County Register) to gain appointments and help them to advancement in their careers.
- (2) To stimulate keenness and efficiency in the science and practice of dairying and poultry-keeping in all branches by :—
 - (a) Circulation of free literature.
 - (b) Meetings and lectures.
 - (c) Educational excursions.
 - (d) Social events.

The following code of rules, drawn up by the Committee, may be of interest :—

- (1) *Constitution.*—(a) The Association shall be governed by a Committee not exceeding 16, including the Officers of the Association and the County Dairy Instructress, who shall be an *ex-officio* member of the Committee.
 (b) The Officers of the Association shall consist of a President, Chairman, Hon. Secretary, Hon. Treasurer.
 (c) The Committee, with the exception of the President, shall be elected at the Annual General Meeting, and retiring members shall be eligible for re-election. Nominations to be sent in to the Secretary 14 days previous to the meeting.
 (d) Alteration of rules shall only be made at the Annual General Meeting, but the Committee have power to make bye-laws for the successful conduct of the Association.
 (e) The Honorary Members (Class II) shall not exceed 25 per cent. of the total membership, or 25 per cent. representation on the Committee.
- (2) *Eligibility for the Association.*
 CLASS I.—For all students who have attended a course of instruction at the Wilts County Dairy School.
 CLASS II.—For those resident in the County of Wilts who are connected with the Dairy Industry and who are considered by the Committee as eligible for Honorary Membership.
- (3) *Subscriptions.*—All members of the Association to pay an annual subscription of 1s. (one shilling).
- (4) *Change of Address.*—In order to keep a correct register of appointments, members are requested to inform the Secretary of any change of address.
- (5) *Appointments Register.*—Only students in Class I who have gained a Certificate of Proficiency at the Wilts County Dairy School will be eligible for the Appointments Register. Applicants for the Register should apply to the Department of County Agricultural Education, Polebarn House, Trowbridge. All persons included in the Register will be circularized with particulars of vacant appointments.
- (6) *Committee Meetings.*—The Committee to meet not less than four times a year. The Agenda to be circulated at least 14 days before the date of meeting.

The Association has received the support of the County Agricultural Education Committee, with which a *liaison* is maintained by the President, who is a member of that Committee. Educational activities since the formation of the Association in November last year have included a dairy conference, district lectures on poultry-keeping, dairying, agriculture, etc., milkers' competitions and exhibitions at the Bath and West Show. Educational tours have been made to the British Dairy Institute at Reading and to Mr. Ernest Debenham's farms in Dorset. On the social side, a very successful county whist drive and dance was held in the early part of the present year, as a result of which the Association's funds were increased by nearly £12. The first number of the Journal of the Association has been published; it contains "student news" and technical articles by leading authorities.

In the coming autumn, it is hoped to hold churning competitions, and to arrange correspondence courses in such subjects as book-keeping and commercial correspondence. Students who visit the Annual Dairy Show at Islington this autumn will be able to meet one another and the County Dairy Instructress on any of the four days of the Show, by attending at the stand of the British Dairy Farmers' Association at 12 noon.

The total membership of the Association is now approximately 150, and judging by the keenness and interest shown by the members, the example of Gloucestershire, Wiltshire and Worcestershire in forming Associations might well be followed in other counties.

In forwarding these particulars, Mr. Price wishes to acknowledge his indebtedness to Mr. Hollingworth and Miss Colnett for their valuable assistance in connexion with the formation of the Wilts. Association.

* * * * *

FOR the purpose of compiling forecasts, observations are taken at the same hours four times daily at a large number of stations and telegraphed to the Meteorological Office. That Office then prepares weather maps, embodying the main features of these observations, and compiles forecasts accordingly.

A. Published Forecasts.—A map based on observations taken at 6 p.m. is published in some of the London morning newspapers. It is accompanied by a "general inference"—that is to say, a general description of probable weather

movements—and by forecasts for different districts of the British Isles (“district forecasts”) for the day. A “further outlook” is always added when indications are sufficiently definite to justify extension of the forecasts beyond the day of publication. Other newspapers (town and country) usually publish the “general inference” and the “district forecast,” but not the map; information necessary for constructing a map is distributed by wireless telegraphy (see B (2) below) but most farmers will not be able to make use of this.

B. *Forecasts by Wireless Telegraphy*.—(1) At 9 a.m. and 8 p.m. G.M.T. the “general inference” is sent out in plain language. It forms the first part of a message issued for mariners and headed “Weather Shipping.” The inference is, however, drawn up for general use on land as well as at sea. It is sent out in Morse Code on a wave length of 4,100 metres (continuous wave).

Those who possess wireless sets of sufficient range, and can read the Morse Code, can thus obtain considerably later information than that published in the newspapers.

(2) In addition to the above the Meteorological Office broadcasts in code four times daily the observations recorded one hour previously at 22 British stations. From these observations weather maps can be constructed.

C. *Forecasts by Wireless Telephony*.—Provision is made for those who possess wireless receiving sets capable of receiving local broadcasting, by the issue twice each evening of a general weather forecast for the day following covering the whole of the British Isles. A “further outlook” is added whenever possible. These forecasts are included in the “General News Bulletin” broadcast by the British Broadcasting Corporation from all their stations. Should the two evening weather forecasts referred to be missed, an indication of the next day’s weather may be obtained from the “general inference” which forms the first part of the evening forecast for shipping (Weather Shipping message) broadcast from the high power station of the B.B.C.

Special morning forecasts for farmers are also broadcast from the high power station of the British Broadcasting Corporation. Those forecasts are given for districts and apply to the 12 hours after they are issued. A “further outlook” follows the district forecasts and a “general inference” is added.

The times of transmission of these issues vary to some extent, but particulars are always available in current wireless periodicals and in the daily press.

D. *Forecasts by Telephone.*—Forecasts can be obtained by telephone at any time by ringing up the Meteorological Office ('Phone Holborn 3434, Extension 174). No charge is made for this service, the only expense to the inquirer being that of the telephone call.

E. *Forecasts by Telegram.*—(1) Regular forecasts for 24 hours or more in advance are dispatched by telegram daily to subscribers. These forecasts are normally issued in the afternoon, to cover the weather of the following day, but forecasts for the same day can be issued in the early morning if desired. For these telegrams a fee of 6d. per week, plus telegraphic costs (calculated on an average of 1s. 3d. per message) is charged.

(2) Another type of forecast, which is sent by telegram, gives notification of the setting in of spells of fair settled weather and of their break-up. These telegrams are not issued on regular dates, but as called for by the conditions. The charge is 6d. for each message, in addition to the cost of the telegram.

(3) The Meteorological Office will also send by telegram forecasts of any special weather which the applicant specifies, such as warnings of frost, ground frost, etc., at a fee of 2s. 6d. in addition to the cost of the telegram.

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THE latest of the Ministry's series of Miscellaneous Publications to be issued is entitled "Weeds of Arable Land."*

The part played by weeds in farm economy has long been recognized by practical farmers, and the Ministry has repeatedly directed attention to the subject since the year 1900 when a leaflet on Charlock was issued. Since that date, numerous leaflets on the subject have been issued, both separately and in bound form, but the latter has now been withdrawn. The separate leaflets will continue to be available.

It cannot but be of great value to farmers and gardeners to be in a position to recognize weeds, and to have a knowledge of their life history and habits. Such a knowledge of a given weed will at the outset often enable one to judge whether it is likely to cause serious trouble, and will largely indicate what type of protective and remedial measures may most

* Miscellaneous Publications, No. 61, obtainable from the Ministry, 10, Whitehall Place, London, S.W. 1, price 2s. 6d. (in cartridge covers), 3s. 0d. quarter bound, and 3s. 6d. in cloth boards.

successfully be adopted. Some 110 weeds are dealt with individually in this manner in the book under notice, and in addition there are general chapters covering the damage done by weeds, weeds as indicators of soil conditions, how weeds are distributed, numbers of weed seeds produced, methods of prevention and suppression, the compulsory destruction of weeds, seed testing, and injurious weed seeds in grasses and clovers harvested for seed.

The book is written simply and is illustrated by 101 photographs and drawings, many of which occupy full pages.

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A PRELIMINARY note as to the arrangements for the Agricultural Section of the Conference of Empire Meteorologists, 1929, appeared in this JOURNAL for July, 1929, pages 312-313. The following information is issued in amplification of this note. The main aim of the Section is to bring together meteorological and biological workers throughout the Empire, in order to discuss methods by which the workers of the two sciences can be mutually helpful. The Agricultural Section of the Conference will deal with questions of Agricultural Meteorology under the following heads:—

- (a) Collection of data for use in agricultural meteorological investigations and the extent to which uniformity is possible.
- (b) Opportunities for research in agricultural meteorology and methods that can be applied.
- (c) The use of meteorological data in the improvement of crop estimates and the supply of weather warnings to farmers.

Subject to the decision of delegates to the Section the programme of the Section will be as follows:—

WEDNESDAY, AUGUST 28, 1929 : Joint Sessions of General Conference and Agricultural Section.

Morning : Seasonal Forecasting.

Afternoon : General Climatology.

THURSDAY, AUGUST 29, 1929 : Agricultural Section.

Morning : Historical Review.

Plant Physiology and Meteorology.
Light and Growth.

Afternoon : Fruit Production and Meteorology.

FRIDAY, AUGUST 30, 1929 : Agricultural Section.

Morning : Climate and Animal Distribution.

Weather and Insects.

Weather and Fungus Diseases of Plants.

Afternoon : Use of Meteorological Data in the Improvement of Crop Estimates.

SATURDAY, AUGUST 31, 1929 : Agricultural Section.

<i>Morning :</i>	{	Visits to the Lord Wandsworth Agricultural College, Long Sutton; and the Royal Horticultural Society's Gardens, Wisley, to inspect agricultural meteorological work.
<i>Afternoon :</i>		

MONDAY, SEPTEMBER 2, 1929 : Agricultural Section.

<i>Morning :</i>	{	Visit to Rothamsted Experimental Station to inspect agricultural meteorological work.
<i>Afternoon :</i>		

In addition to the papers noted above for Thursday and Friday, August 29-30, it is hoped that there will be papers contributed by Overseas delegates. It is further hoped to prepare accounts of the organization and results of agricultural meteorological work in this country and other countries of the Empire, as well as in certain foreign countries.

The meetings of the Section will be held in the Large Hall at the Civil Service Commission, Burlington Gardens, W. 1.

A cordial invitation to attend the meetings is extended to all those workers in the Research, Advisory and Educational Services of Great Britain who are interested in one or more of the various aspects of agricultural meteorology. It would however, be appreciated if those who propose to attend would notify in advance the Secretary (Agricultural Section), Conference of Empire Meteorologists, 10 Whitehall Place, London, S.W. 1. Copies of papers to be read and of documents prepared for this Section will be forwarded as soon as possible to those who notify their intention to be present.

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Notes from Abroad.—The United States and Canada are working together in the organization of an effective representation at the World's Poultry Congress,

World's Poultry Congress to be held at the Crystal Palace in July, 1930. Delegates from these countries, expected to number at least 1,000, are co-operating in arrangements for their journey, which will be made in a specially chartered liner. In both countries numerous Sub-Committees are actively engaged on particular aspects of the Congress. In the United States the General Committee is under the Chairmanship of Dr. Morley Jull, and there are no fewer than twelve Sub-Committees at work. The Hon. Harry Lewis, President of the U.S.A. National Poultry Council, is Chairman of three Sub-Committees, namely, those concerned with the commercial exhibit, with travel and accommodation, and with legislation. A Sub-Committee is actively concerned with the United States

national exhibit, and as a substantial Government grant has already been made towards the cost of preparing and staging this exhibit there should be a very attractive display from the United States at the Crystal Palace.

The Canadian National Committee is under the honorary Chairmanship of the Minister of Agriculture, the Right Hon. Dr. W. R. Motherwell, and includes all the Ministers of Agriculture of the Canadian provinces. The executive Sub-Committees form a very strong list, with Mr. F. C. Elford as the leader. It seems probable that the live bird exhibit from Canada alone will amount to over 1,000 birds, and the national exhibit will be on an elaborate scale.

Interest on the part of Continental countries is no less keen. Substantial space has been booked by many countries for the purpose of staging national exhibits. The German National Committee has just sent in a request for 1,500 feet of floor space. Holland is taking a space at least as large. France, Spain, Belgium, Denmark and the Netherlands are among the other countries who intend to exhibit in this section of the Exhibition.

Preparations at Home.—With such keenness on the part of other countries, it is most desirable that the United Kingdom should not be lacking when the time comes. As host of the Congress, the British Government will take the responsibility for staging a worthy national exhibit.

The matter is well in hand. The Congress Director recently returned from a tour of the United Kingdom with Mr. Claude Taylor, of the Department of Overseas Trade: Ideas gained on this tour will be reflected in the national exhibit now being planned. The aim will be to show, as far as is possible by such means, the high standard of efficiency reached by the British poultry and small livestock industries and the important part played by education and research in developing the industries to that standard of excellence. There will be a marketing display for which preparations are being made by the Ministry.

The keen demands which are being made for space both in the trade section and the livestock section of the Exhibition justify the opinion that the Congress will prove a great popular attraction. A large area in the South Nave, which will be devoted to the trade display, has been applied for by commercial interests, and there can be little doubt that the whole of the available space will be taken well before the opening of the Congress. The Organizing Committee is taking

adequate steps to ensure that this trade display will be unique in the annals of poultry exhibitions.

In the livestock section the difficulty of finding room for all the demands likely to be made by British breeders is already evident. The poultry and small livestock industries are beginning to realize that there has never been such an opportunity of bringing the merits of British breeds to the notice of the home public and of buyers from overseas. Although it is very early for most prospective exhibitors to be sure of the kind of stock they will be able to show, many definite entries for poultry, pigeons and rabbits have already reached the Congress Secretary.

There seems every prospect that the Congress will be a great success. The active, wholehearted support of every section of the industry has been enlisted, and the programme will make such an appeal that the record of 200,000 visitors established by Canada at the 1927 Congress at Ottawa may quite easily be exceeded. Those who wish to take part in the Exhibition are strongly advised to apply immediately, if they have not yet done so, to the Congress Organizers at 10 Whitehall Place, London, S.W. 1, for full information regarding the arrangements.

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<p>Travelling Scholarships for Grocer Students</p>	<p>IN this JOURNAL for January last, reference was made to an experiment which the Ministry was then planning whereby a tour of England and Wales was to be offered to a number of students taking the highest places in the final examination of the Institute of Certificated Grocers. This tour has now taken place.</p>
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On Monday, July 8, the Rt. Hon. Noel Buxton, Minister of Agriculture, welcomed at the Ministry 17 students (2 of whom were Scottish), 5 accredited teachers, and 2 officers of the Institute. "The distributor," Mr. Buxton said in a written message, "is the court of last resort, and if he has not absolute power to create or sustain demand for any article of food, his direct contact and personal influence with the consuming public enable him quietly and unostentatiously to do probably more than any advertiser to divert demand from one brand or kind of an article to another. The home producer recognizes this and looks confidently to his fellow-countrymen in the distributive trades to put themselves in the position actively to push home produce in preference to

any other so far as available supplies will allow. There will be no resistance to such a sales effort, for it is generally accepted that we start life with certain primitive instincts, and nothing savours more of instinct and less of calculation than the natural impulse of the British housewife to buy British goods. The home producer is not, of course, deluded into thinking that this valuable preference absolves him from marketing his produce on up-to-date lines. He realizes that the complexities of distribution in our towns and cities now make it imperative that his produce should be offered to the trade in a form and manner which make it easy to handle and easy to sell. He realizes, too, that the consuming public is every year becoming more intelligent and discriminating in buying and now seeks some sort of implicit guarantee of cash-value for its purchases. The home producer is out to meet these changed and changing conditions, and he is doing so by a policy of standardization of grading and packing, which is a policy of service to trade and public and the key-note of efficient marketing under modern competitive conditions. The recently launched National Mark schemes for home-produced eggs and other home produce are among the first results of this forward movement and an earnest of bigger things to come."

The party then left, by charabanc, for Hungerford, to inspect the premises of the Wiltshire Egg Producers, who are registered packers under the National Mark Scheme. Thence they journeyed through Calne, the Cheddar country and the fruit-producing districts of the West Midlands to Birmingham, and from there through the Cheshire cheese country to Harrogate. During this time they were shown Messrs. Harris' and Messrs. Marsh & Baxter's bacon factories, the processes of cheese making on a Somerset farm, the production of condensed milk by the United Dairies at Melksham, egg-grading at Cheltenham, fruit canning at Ashchurch and research at Campden, Co-operative marketing at Pershore, the manufacture of Cheshire and of crustless cheeses, besides poultry, pig, and fruit farms. At Harrogate a day was spent at the Royal Show, during which a careful study was made, in the light of what had already been seen, of the Ministry's marketing demonstrations. During the homeward journey the party saw Stilton cheese-making, pea-packing by Messrs. Joseph Farrow, at Peterborough, potato-packeting at Spalding, fruit and vegetable canning by the Wisbech Produce Canners, the cider-plant of Messrs. Gaymer, Messrs. Chivers' manifold activities, and glasshouse cultivation in the Lea Valley.

At the conclusion of their tour they were entertained to dinner by the National Farmers' Union, finally returning home, with a considerable knowledge of the value of home produce to their own businesses.

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On Tuesday, July 9, the Rt. Hon. Noel Buxton, M.P., Minister of Agriculture, accompanied by Mr. Ben Riley, M.P., Parliamentary Private Secretary, Sir Charles Howell Thomas, Permanent Secretary, and Mr. A. W. Street, Assistant Secretary, visited the Stand of the Beet Sugar Factories Committee of Great Britain, where the cultivation of Sugar Beet was reviewed from an educational standpoint.

The main point of the Stand was to show how improvements could be effected through experience and education in every branch of the work. Diagrams were used to illustrate essentials for success and causes of failure, while a plate showed the complete root formation of a well-grown beet as opposed to that of a very "fangy" beet resulting from bad cultivation and unsuitable soil. Other plates, in natural colours, showed the leaf formation and appearance of a healthy beet, where well-balanced artificials had been used; and alongside these were shown beets suffering from a lack of potash, nitrogen and phosphoric acid, in which a marked difference in the colour of the leaves could be observed.

A further series of plates demonstrated the great benefit accruing to following crops when sugar beet had been grown in place of mangolds or other roots; a complete set of photographs illustrated the 18 factories operated by the companies constituting the Committee; and there was a display of samples of dried pulp, molasses pulp and white sugar.

There was also exhibited the uniform rasp of 60 teeth to the square inch agreed between the Factories Committee and the National Farmers' Union to be used at all the factories for the next two years of the Beet Contract, by means of which the pulp from the sample beets is obtained in order to ascertain the sugar content, which is the basis of payment to the grower.

Literature was available dealing with the cultivation of sugar beet and the use of dried beet pulp, as well as the general progress of the industry from the educational and other standpoints. The stand was in charge of Mr. Andrew Aitken, the Exhibitions Officer of the Committee.

Egg Scheme.—The number of egg packers in England and Wales now authorized to apply the National Mark is 185, and while there are only six situated in Wales, there are packing stations in practically every county in England. **Marketing under the National Mark** The output of eggs under the Mark has been steadily increasing. The issue of National Mark labels during the first half of this year amounted to 780,650 box and 1,353,300 carton labels. Retailers, in general, are gradually realizing the advantages of dealing in National Mark supplies and there has been a marked advance in some areas. In Birmingham, for example, the demand for National Mark eggs is definitely growing, and the number of shops selling them has practically doubled within the last three months. In Sheffield, an energetic campaign is being undertaken by one of the registered packers.

Registered packers are being encouraged to pack a greater proportion of their supplies under the Mark, and to this end the Minister has made a requirement that in future all packers shall pack under the National Mark labels such minimum proportion as the Minister may from time to time determine of the packers' total sales of eggs produced in England and Wales, exclusive of sales of eggs purchased in containers to which National Mark labels have previously been lawfully applied. The proportion at present required is one-third of the total sales, as defined above.

A further inducement to packers to increase the proportion of sales under the Mark is given by conditional permission to reproduce on their business stationery the National Mark, which has been officially registered in the name of the Minister as a trade mark under the Trade Marks Acts. To obtain this privilege a packer must have packed under the Mark, in two consecutive months, not less than two-thirds of his throughput of English and Welsh eggs, exclusive of resales of pre-packed National Mark eggs, and must undertake to continue to pack no less a proportion under the Mark.

Tomato and Cucumber Scheme. — The number of authorized packers in this scheme has increased to 76 for tomatoes and 23 for cucumbers. Supplies are coming on to wholesale markets in larger quantities; the quality, grading and packing of the fruits are particularly good, and the demand is very satisfactory.

MORE OBSERVATIONS ON THE METHOD OF FIELD EXPERIMENTATION

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PROBABLY no part of the work of the Agricultural Adviser has been the subject of more persistent criticism than the attempt to apply the experimental method to the elucidation of practical farm problems. Hitherto the attack has come on the one hand from farmers, sceptical of the practical value of all work done on less than field-wide scale, and distrustful generally of "theorists" and all their works, and on the other hand from the statistician, skilful computer of the "odds on" and stickler for the "dead cert." To these must now be added (this JOURNAL, July, 1929, p. 341) a third class of critic—the economist, the arch-realist of the advisory service, privileged of access to the very arcana of farm practice, insistent upon the balance sheet as the final criterion of the value of any professed contribution to the advancement of the farming industry.

Of the three critics the statistician alone does not dispute the validity of the experimental method. He is solely concerned to secure that the interpretation of the results of the experiment shall be kept within the limits imposed by the degree of reliability of the data obtained. If, for example, the method of experiment is incapable of measuring with a fair degree of certainty differences smaller than 10 per cent., he insists that no significance must be attached to differences below this figure. Much of the criticism of experimental work finds its point in neglect to observe this obvious precaution, the fault thus lying, be it noted, against the experimenter and not against the experimental method. It is here where the word of criticism is still required, and we shall return to the point later.

The attack of the farmer—reinforced now by the economist—comes from quite a different angle, being directed against the experimental method itself. "The trouble . . ." says Mr. Dixey, "is due . . . to the attempt to use the experimental method at all for purposes for which it is not suitable." True, a few lines later he hedges with the more guarded expression of opinion that "the experimental method is not the best method of studying farm practice," but the whole trend of his argument indicates that the "at all" of his first thoughts gives the more accurate indication of his views.

On what grounds, then, are we to abandon the attempt to help agriculture by "practical" experiments? Firstly, because they are carried out under conditions which are "purposely artificial,"—"an essential characteristic of any experiment" we are told. Secondly, and "even more serious," because of "the impossibility under such circumstances of relating the results to the economic factors of cost, and so to profit."

The memory of the oldest experimenter will not carry back to the day on which these criticisms of agricultural experiments were first made, and an apology is surely necessary for exhuming once more the corpse that has been so frequently buried and disinterred!

The Experimental and Survey Methods Compared.—In what respects is the ordinary experiment—say a manurial trial—artificial? Small plots? These can be adjusted in size to suit the taste of the critic, if he is prepared to foot the bill. The advantage of the larger area lies mainly in the psychological effect upon the farmer-observer. Control of amount of seed and manures applied? Surely copying the practice of the best farmers! Preparation of the land? This is usually done in precisely the same fashion as the rest of the field, with the same implements and labour, often before the site of the experiment is actually selected. The only operation in starting the experiment which need disturb the ordinary routine of the farm in the slightest is the application of the manures, and the disturbance amounts only to a loss of time, the mode of application remaining "practical." Throughout the growth of the crop no distinction of treatment need be made between the experimental area and the rest of the field. Finally, at harvest the only discrimination necessary is a little adjustment of routine to ensure that the produce of each experimental plot is kept separate, again involving only a slowing down of the rate of progress of the harvesting operation. Wherein is the "artificiality" of all this—so gross as to condemn the whole business of experiment? Apparently only in the use of the measuring-chain and the weighbridge, implements which will hardly be described as "artificial" when used for the purpose of securing more accurate data for the economic surveyor!

It may be true that in the measurement of very fine differences the greater care exercised by the experimenter may enable him to demonstrate a difference which cannot

be secured in the cruder routine of the farmer, but differences of this order of magnitude would not in any case have any significance for practice. Whatever the defects of the experimental method "artificiality" is surely the least, and to suggest that this is a potent factor in delaying the improvement of practice among the general body of farmers is pure nonsense. Far more potent factors require no seeking in the files of the advisory economist !

As to the condemnation of the experiment because its results are not directly translatable into terms of financial profit or loss—this criticism can only apply to experiments which are directly designed to give information on financial results, otherwise it is pointless. If the object of the experiment, however, is simply to compare the crop yields obtained by two different treatments, it can only be judged with reference to the degree of success with which it achieves this object. If the experimenter is foolish enough to draw conclusions beyond the warrant of his data he may rightly be derided, but the value of his experiment is thereby in no wise affected. The "economic survey" is subject to precisely the same limitations ; the validity of any conclusions drawn from it is determined by the character and reliability of the data accumulated. Any adventure in interpretation beyond the limitations thereby imposed is pure speculation, and open to criticism as such without affecting the value of the survey.

The only issue for debate therefore is whether an experiment which is not capable of being summed up in a reliable account of profit and loss can be of any practical use to the farmer. We may concede that until the economics of the problem have also been investigated it cannot represent more than the half-loaf, but as such surely it is not to be despised. We certainly cannot accept the assertion that the plot experiment "cannot give any real guidance as to cost or profit." There should be no difficulty in supplying the rest of the loaf by experimental methods if the necessary facilities and resources are available. Indeed, it can only be by the application of scientific method to the investigation of costs and profits that reliable results can be obtained. The idea that the "plot experiment" is incapable of supplying reliable economic data can only arise from the curious obsession that "plots," whether of land or of live stock, must necessarily be small, uneconomic units. No such restriction is imposed upon the method of "plot experiment," and it is only considerations of cost and labour which have caused experimenters to limit their

activities hitherto so largely to small-scale experiments which can only give results in terms of physical output.

It is true that the results obtained at any one experimental centre are strictly valid only for the conditions obtaining at that centre during the period of experiment, and consequently by themselves cannot serve as a basis for generalization, but the remedy for this is found precisely on the same lines as in the economic survey—by multiplying the points of observation.

Even with this amplification, however, the results of the experiment may show a degree of variability which compels the honest experimenter to interpret them as warranting only modest odds in favour of Practice A as against Practice B, leaving it to the individual farmer to use his own judgment, fortified possibly by a rough experiment, as to whether his own conditions fall within the majority or the minority group. This moral honesty on the part of the experimenter must be accounted to him for virtue, and no lower standard can be accepted from the exponent of any other method of providing guidance for the farmer.

But whilst we fail to find any real weight in the argument of the economist against the experimental method, we are conscious of its difficulties and defects in other directions, and would only too gladly surrender it for any adequate alternative that might be less laborious and less costly. Does the "survey method of economic research" provide such an alternative? To us it would appear to suffer from the fundamental defect that a survey can only deal with existing practice, and can do little or nothing therefore to accelerate the introduction to practice of new discoveries as they emerge from the research laboratories. Such discoveries can only come within the purview of the economic surveyor when they have become sufficiently widely established in practice to furnish an adequate number of recording centres for the purposes of the survey.

In most cases, however, the jump from the artificial conditions of the laboratory to the commercial farm is too violent to be taken at a single bound, and many discoveries which have subsequently proved to be of real practical value, have been severely disparaged in their earlier stages through premature introduction into practice, with consequent damage to the prestige of scientific research and loss to the farmer. It is rarely that the results obtained in the laboratory, pot-culture station or metabolism cage can be safely introduced into practice without being first thoroughly tested out under controlled conditions which approximate closely to practice,

in order that the farmer may have some assurance of a reasonable chance of success before risking his money. This function the "practical experiment" can fulfil admirably; the economic survey only comes into action at the later stage when the farmer himself has started to "experiment." Its function is rather to supplement than to replace the experiment. Before the farmer starts to experiment he should have some guidance as to the chances of success. Farming is inevitably a speculative occupation, but with the results of experiments before him the farmer can at least restrict his "flutters" to the "odds-on" candidates amongst the new-comers in the way of professed advances.

Even within the limits of existing practice, however, does the economic survey method promise to give more explicit guidance than the experimental method? Judging by the illustrations given by Mr. Dixey this would seem to be very doubtful. From a survey of the records of 130 farms in 1926 he demonstrates that the farmer who drilled his sugar beet at less than 20 inches between the rows tended to get a heavier crop of beet than the man who drilled at a greater width. This point, however, was apparently established even more conclusively by the application of the experimental method at only five centres in the west of England! In Mr. Dixey's results out of every 100 farmers using the 20-inch (or narrower) drilling, 38 obtained less than 10 tons of beet per acre, and 62 over 10 tons per acre—chances of roughly 6 to 4 in favour of obtaining a crop of 10 tons or more with the narrow spacing. Out of every 100 farmers using the wider spacing (over 20 inches), 54 obtained less than 10 tons, and 46 over 10 tons—or chances of roughly 11 to 9 against obtaining a crop of 10 tons with the narrow spacing. Put in another way, we might say that in the first group there would be 38 farmers dubious as to the superior merits of the narrow spacing, and in the other group 46 farmers similarly dubious. Surely no very clear guidance here to the *individual farmer*. By contrast the *experimental* results show an enhanced yield with the narrower spacing in every case, and abundant confirmation can be adduced from experiments elsewhere that, when other factors are as nearly equal as possible, the advantage of the narrower spacing, though not invariable, is shown with a much higher degree of frequency than the survey results suggest.

The position is no better when we turn to the information given by the survey as to the financial outcome of the different

spacings, as again we find only modest odds in favour of the narrower spacing, and the individual farmer is still left under the necessity of testing for himself the degree of applicability of the general conclusion to his own particular circumstances.

It is perhaps not without intention that Mr. Dixey has selected for his illustrations the sugar beet crop, since in this case reasonably accurate data for production—of roots at any rate—are available in the factory returns. But what of other crops for which the production data obtained by the economic surveyor are liable to be little more than crude estimates? How can the analysis of such data give more than the roughest guidance as to the comparative merits of different practices?

Moreover, to return to the sugar beet illustration, what assurance have we that the differences in results between the two groups of the survey analysis were simply due to the different widths of spacing the beet? The intelligent and enterprising farmer taking up a new crop will exert himself to find out what is regarded as the best practice amongst those who have experience in growing the crop, and in the case of sugar beet he would soon discover the prevalence of the narrower spacing in the old-established beet-growing areas, and a considerable amount of confirmatory evidence from experimental work in this country. Is it not possible, therefore, that the level of intelligence and enterprise was higher among the "survey" farmers using the narrower spacing than in the other group, and that this may have contributed materially to the differences in the results recorded? The "surveyor" would doubtless shrink from any attempt to grade his clients according to "capability," but may he not unwittingly have done so roughly by his classification on the basis of spacing!

We have laboured the point, perhaps to the verge of absurdity, in order to demonstrate the uncertainty which must necessarily attach to any conclusions arrived at by the survey method as to the comparative merits of different variations of technique, in view of the many other variables by which the results may be affected. Only by taking farms on each of which the different variations have been practised side by side can this difficulty be overcome—but this is the experimental method!

We are unable, therefore, to accept the economic survey as more than a partial and very imperfect substitute for the experimental study of a wide range of practical farming problems, but we welcome its development as a valuable

adjunct to the latter, furnishing the means of obtaining a rough check as to the extent to which the experimental results can be incorporated into farm practice with success.

Difficulties of the Experimental Method.—At the same time we would not deny that the experimental method has been sadly misused in its application to the study of agricultural problems. As far as past experimental work is concerned the most serious defects have perhaps lain in faulty design and in uncritical interpretation of the data obtained. The importance of so planning an experiment that the results are capable of only one interpretation is obvious, but the difficulty of securing this end in even the simplest type of experiment is greater than is commonly recognized. The simpler the plan of an agricultural experiment the better, and yet over-elaboration of the experimental scheme has always been a common failing and still persists. It arises from the natural desire to obtain as much information as possible in the minimum of time with the experimental facilities available—facilities which might be adequate for the attack of one simple problem were the experimenter only content with this, but which only result in failure when subdivided for the simultaneous attack on several problems.

The history of manurial experiments teems with examples of mistaken enthusiasm of this character. The experimenter starts with a simple scheme of, say, five plots to test the effects of four different combinations of nitrogen, phosphate and potash. The fatal facility of cross-dressing then tempts him to elaborate his scheme by subdividing his basic plots transversely and applying different cross-dressings on the various sections. One cross-dressing gives him 10 plots, a second 15, a third 20, and so on—all sheer futility so long as he has only one plot of a kind. If his resources and energy have enabled him to deal with 20 plots, how much better it would have been for him, instead of trying to test 19 points at once, simply to have quadruplicated his original five-plot scheme on the area with plots one-quarter the original size ! Then he would at least have secured results of assessable reliability on the original four issues he set out to investigate, and have thereby made a definite contribution to knowledge. With the procedure adopted, however, every one of his 19 comparisons is valueless because he cannot assess the reliability of his results, even to the extent of guaranteeing that the plus differences do actually represent beneficial effects, or the minus differences detrimental effects, of the treatments

compared. At most he may perhaps claim that, assuming his conditions of uniformity of soil, &c., to have been average, differences of the order of 15 to 20 per cent. between plot yields are probably significant, but his assumption is purely speculative.

The "single plot" experiment should nowadays be relegated to the function of qualitative demonstration of points already established by more precise forms of experiment, and if no weighings of crops are taken the temptation to use them is effectively avoided. It is only when the "single plot" experiment forms one of a series carried out on a uniform plan at different centres that the recording of quantitative results may be justifiable, and even then the greatest caution is necessary in drawing conclusions from the whole series of results obtained at the different centres. The averaging of results in such co-operative tests is inadmissible and usually pointless, and it is rarely possible to do more than compare the general trend of the results at the various centres. The average crop on Plot A at ten centres may be actually less than that on Plot B, and yet if, as may well happen, Plot A is found to have stood first in order of merit at seven out of the ten centres, the intrinsic superiority of the treatment applied to this plot can hardly be questioned.

Even in co-operative work of this character, however, it is desirable that each plot shall be at least duplicated at every centre, in order that some guidance may be available as to the validity of the results before they are embodied in the general comparison. If the results of "single plot" tests are valueless in themselves, it is obviously worse than futile to use them as the basis of further computations such as costs, feeding values, etc., and no criticism of excursions in this direction can be too strong.

To sum up, whilst we have stressed the difficulties of the experimental method and the defects of much of the work in which it has been applied, this in no way affects the fundamental value of the method and its usefulness for the solution of a wide range of practical problems. Provided the experiment be so planned as to measure the effect studied with the degree of accuracy essential for practical purposes, and the interpretation of the results be confined within their range of validity, we can conceive of no other method of attack on practical problems which can give as reliable guidance to the individual farmer.

JEALOTT'S HILL RESEARCH STATION

THE Jealott's Hill Station is the new research headquarters of the distributive and research organization for the farm fertilizers' side of Imperial Chemical Industries. It will be both complementary to the manufacturing side of Imperial Chemical Industries activities, as represented by the great factory at Billingham-on-Tees, and a centre of the Company's organization for farm research which extends throughout the Empire, and indeed throughout the world. The new station will make possible a much greater degree of co-ordination in this work.

The station comprises two farms, Jealott's Hill and Nuptown, at Warfield, Berkshire, the acreage of the former being 360, of which 160 are under the plough; while the latter consists of a grass holding of 76 acres. It is equipped with extensive laboratories for analytical work of all kinds, and for research into such subjects as animal nutrition, biochemistry, botany, plant physiology, bacteriology and general microbiology. The laboratories and office buildings comprise an optical and photographic dark room, a sterilizing room, a machinery and preparation room, library and conference room, staff common room, kitchens, etc.

The new station was formally opened by the Rt. Hon. J. H. Thomas, M.P., on June 28.

In the course of an address to the guests, Lord Melchett observed that one great quality about scientific work and about research is that they have no boundaries. One could not confine scientific knowledge to countries, or even empires. It is of its very nature and essence world-wide, international and interchangeable, and he was glad to think that it is also co-operative nationally for the benefit of the entire world and of all humanity.

Agriculture is still the foundation of human prosperity, and it is one of the curious paradoxes of our economic world that throughout the whole of the world you have an agricultural crisis. The man who produces the most essentially necessary and fundamental substances of existence, namely, food for us to live on, is everywhere the man who is least regarded and worst remunerated. That is why, throughout the world, we read of an agricultural crisis. Farming is the most ancient industry in the world, and the one which has received, on the whole, relatively a much less amount of scientific attention than other industries which are more modern. The amount

of research in agriculture is entirely inadequate to the importance of the problem.

It is not, he said, the spirit or intention that the new institution should be confined to helping Imperial Chemical Industries to improve the goods they happen at the moment to manufacture. There are many other problems which one is only dimly beginning to see regarding soil conditions, including the question of turning one condition of soil into another, and of studying the physical and colloidal conditions of soil. Again, there is, what is equally important, the question of plant nutrition and of fertilizers, natural and artificial. All this class of work is being very carefully examined, and will be carried out at Jealott's Hill as a nerve centre of experiment which will be conducted all over the world by competent observers, capable of examining objectively and of recording results, and of continually feeding us with the material of their observations. Thus can be drawn wide conclusions which can be applied generally. He said objectively, because there is nothing more difficult than to get objective observations of agricultural results. There are so many elements—the weather, the soil, the temperament of the gentleman who is making the observations, the objects with which he is making them.

The Rt. Hon. J. H. Thomas, P.C., M.P. (Lord Privy Seal), said that in agriculture and science, as in all our other problems, all our difficulties, all our misunderstandings, are, in the main, brought about by people who will not face facts. They are brought about, above all, by ignorance and prejudice and suspicion, and a failure to realize that the process of evolution always means something better than that preceding it. It means always an anxiety and a desire to get of the very best, and to-day we are opening a new branch of research. Equally in the realm of business, in the realm of knowledge, let us get the best, let us explore, let the laboratories give us of their best, let the colleges give us of their best. Anything that can contribute to the well-being of the world is good ; anything that can increase the production of the world is good ; anything that says mankind must develop and prosper is good. Do not let us damp it ; let us encourage it.

Sir David Milne Watson welcomed the farm and research station because it is a practical proposition. They desired to show the actual experiments and so enlarge the practical knowledge of farmers in this country. Pamphlets were all very well in their own way, but farmers when they returned tired from a day on their farm might well be excused if they

preferred an armchair and going to sleep to reading long pamphlets. He was almost inclined to think that they are a little suspicious of photographs. Things may look very well in photographs, and better than they actually are.

Jealott's Hill had already given evidence of its powers to contribute to the advancement of agricultural knowledge. One of the most striking and valuable facts recently discovered was the proof that by the application of suitable fertilizers and methods of cultivation to grassland, pasture grasses can be hastened into growth from three to four, and even more weeks earlier than they can be under any other process. The evidence of this assertion was now quite conclusive. It had been gathered from all parts of the country and from very different types of soil, and it was therefore not surprising that the idea of "early bite" had already been accepted by large numbers of progressive farmers.

So soon as all the dairy farmers of the British Isles took steps to secure the "early bite" they would be able to provide grass for nearly four million cows on an average of three weeks earlier than they can do by ordinary methods. That would mean a saving of concentrates, hay and roots used for the three weeks' winter feeding of about £3½ million, whereas the cost of procuring the "early bite" by means of fertilizers would be rather less than £2 million—leaving a net saving to the farmers of the British Isles of rather more than £1½ million per annum. All these figures were quite capable of proof.

Sir Frederick Keeble, Director of Research for I.C.I., referred to a passage in Burke's speech on conciliation with America, in 1775, in which, when speaking on the bonds and ties of Empire, he said, "We hold the Colonies in close affection which grows from common names, from kindred blood, from similar privileges and equal protection. Those are ties, which, though light as air, are as strong as links of iron."

It seemed to him that they were endeavouring to-day to forge yet another of those links made from the lighter-than-gossamer nitrogen of the atmosphere, and distribute it to the uttermost ends of the Empire and the earth, and always with the hope of adding to the prosperity both of the homeland and of the Empire. It was that idea which had inspired their efforts.

Mr. John Garton said he had the opportunity only recently of going through several counties and seeing some of the work which is being done. He had seen old marshland

previously covered with rushes turned into very good grazing land, some of the thin chalk land very much improved, and some of what might be called quite good lands further improved. In many places men who had tried the problem of getting early grass had spoken very highly of it, as of great value. He believed the grasslands of this country had been neglected to a very great extent, and did not think that it was altogether that the farmers were ignorant. The economic question came into it to a great extent. The great association he represented was fully alive to the scientific side of farming. They knew perfectly well the value of artificial fertilizers. They knew perfectly well that there was only one way in which the difficulties of agriculture could be faced to-day, and that was by growing the maximum of crops. They knew also that those maximum crops could only be grown by the application of balanced artificial fertilizers.

He was more concerned with the arable situation. The policy of the plough was the foundation of agriculture. It was the arable land of this country that employed the greatest amount of labour; it was the arable land that produced the greatest amount of food per acre; it was the arable land that would absorb the greater part of the artificial fertilizers. At a time like this when we had hundreds of thousands of men out of work, was it a time to let arable land tumble down to grass and the men be turned adrift? He would say that if agriculture was in a good position to-day, the knowledge that could be imparted to farmers would be put more into practice. He believed that they could nearly double the production of this country, but there was that great question, the economic price of the produce, and confidence—and one was dependent upon another. No industry could be made a success without confidence, and one could never get confidence unless the farmer got economic prices for that which he grew.

Sir Daniel Hall drew a parallel between the inauguration of Jealott's Hill Research Station and the development of Rothamsted.

"Something like one hundred years ago that very wise man John Lawes had inaugurated the first factory manufacturing artificial fertilizers, and manufactured superphosphate. After he had started his factory—almost immediately afterwards—he secured the assistance of Gilbert, and inaugurated the experimental station of Rothamsted. That, I think, is a just parallel. I would pursue that parallel further. John Lawes was a manufacturer of superphosphates, but if you go back

to the records of the Rothamsted Experimental Station you will find there little in the way of fertilizers or experimental work concerning the virtues of superphosphate itself.

"There is one memorable paper, but in the main the work of that station was devoted to the advancement of agricultural science at large, and to the development of the knowledge of the use of all fertilizers. Now that, I believe, is the spirit which animates this research station and which animates my friend Sir Frederick Keeble. The Imperial Chemical Industries and this experimental station recognize, rightly enough, that the prosperity of a commercial firm depends upon the prosperity of agriculture, as that, in its turn, depends upon the advance of knowledge and the attempts to get control over the forces of Nature.

"We may hope that the work which Rothamsted did will be magnified by the work that is done here in the way that the Imperial Chemical Industries magnified the work of that original factory making the superphosphate of John Lawes."

"What did the experimental station of Rothamsted do in those years of 1843 onwards? It was one of the means by which during those years between 1840 and 1870 the production from the soil was increased by something like 50 per cent. through the knowledge and application of science and the use of artificial fertilizers. Those years when Rothamsted began were some of the most difficult years of British agriculture. There succeeded a generation from 1840 to 1870 when British agriculture rose to its highest and most prosperous position. I hope the omen and precedent may be followed on this occasion.

"If I may follow the parallel a little further, those two stations have started in similar times. Rothamsted began some years after the devastation of a great war—what was then the world war—and it had to take up its work during the unexampled depression of agriculture that followed the cleaning up of the misery and depression of that war. Is not that exactly our situation at the present time—that we have to create a new method and a new path, and a new principle upon which the farmer may get to work? It was fertilizers which did it then. Perhaps fertilizers may be the factor in doing the thing in the immediate future. At any rate, whatever progress we have got to look forward to in the way of production, we have got to recognize that the immediate need of the situation is to get more out of the existing land. Those great areas of new lands in the world that accounted for so much

production of food in the nineteenth century, those great areas no longer exist, and if we are to have a continually growing population it can only be by means of increasing production from the land and by means of the wise use of fertilizers.

“However, there are certain contrasts between the situations then and now, and one of the greatest contrasts is probably the way in which industries have grown apart from the old primitive business of farming. Go to Billingham and see the marvellous work which is going on in those great chambers and those great halls in which all those marvellous processes are carried on—and almost without human intervention, except for one man here, and one man there, taking records and observing the indications of a dial. Go half a mile away, and you will see one man holding a plough drawn by two horses turning over the soil by the same primitive methods of centuries ago. That contrast exists. Agriculture alone of all the greatest productive industries of the world has not yet been transformed by science in the way that other manufactures have been, whether dealing with steel or textiles or any other thing. Think of the enormous difficulties that we had to contend with there before we had our production, before we made productive the advances of science which we owed to the research stations and to the great manufactures, of which such as this company is at the head.”

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THE RESEARCH SCHEME OF THE INSTITUTE OF BREWING

H. LLOYD HIND, B.Sc., F.I.C.

Organizer of Research for the Institute

THE events of 1914-1918 revealed a lack of co-ordination in scientific research, particularly in its applications to industry, and forced a realization of the fact that the industrial advance of the country was hindered thereby. Recognizing this, the Government set aside a million pounds sterling for the encouragement of organized technical research, and many industrial research associations were formed and availed themselves of grants from this fund. The Council of the Institute of Brewing, which is a technical and scientific association of members of the brewing industry, but not directly concerned with financial and trading matters, formulated a Research Scheme for that industry. This was accorded such a favourable reception and received such a large measure of voluntary support from important brewing and malting firms that it was put into operation early in 1919. In 1925, the financial arrangements for the support of the Research Scheme were reconsidered and placed on a barrelage basis. Since then, a large proportion of the British brewery companies have become corporate members of the Institute and pay a yearly subscription graded according to their output. Subscriptions are similarly paid by most of the malting firms. It has thus been possible to carry on all the research work decided upon with money provided by the trade itself, and without any call on the Department of Scientific and Industrial Research.

The administration of the fund so raised is in the hands of a Research Fund Committee elected by the Council of the Institute and consisting partly of corporate members and partly of representatives of universities, agricultural and other colleges, research stations, companies, firms and private individuals who are providing, or may be able and willing to provide, for the use of the Institute, facilities for scientific education, investigation and research. The Research Fund Committee decides upon the broad lines of the investigations to be undertaken, and then leaves the details and conduct of each branch of research to sub-committees of members more particularly interested in each particular branch. It was decided that no research station or laboratories should be founded at the outset, but that each investigation set on foot

should be entrusted to some specially qualified person and carried out at suitably equipped institutions or works. The Institute has been exceptionally fortunate in this direction in securing the co-operation of specialists of the highest reputation who were able to conduct the investigations entrusted to them under the most favourable circumstances.

The guiding principle of the Research Scheme of the Institute is that the investigations shall be carried out for the benefit of the entire brewing and malting industry. Any results of commercial value would be available for all concerned, and circulated as freely as the reports on the more purely scientific researches. So many different scientific problems are encountered in the technical operations of malting and brewing that the field of investigation is extremely wide and varied, and could only be adequately covered by the enlistment of a large number of specialists—chemists, physicists, biologists, agriculturists, engineers and technologists. Wide apart as these special aspects of the sciences connected with brewing technology appear to be, and beyond the grasp of any one man, they come so definitely to interlace one into another that it was found necessary to appoint an Organizer of Research to co-ordinate them without usurping the special activities of the director appointed for each branch of research. He also had to supply the practical technical knowledge, outside the experience of the scientific research workers, but necessary for the application of their investigations to actual brewing conditions.

Fermentation problems, with which brewing research is most closely identified, have applications far beyond the confines of this industry. How fundamentally important they are can be realized by recalling the immense debt which surgery and medicine owe to the labours of Pasteur, which were so largely based on his brewery investigations. The present state of knowledge of enzymes, of starch and other carbohydrates, with its applications to baking and many other industries and sciences, owes much to workers connected with brewing. Brewing research has indeed done infinitely more for science and humanity than can be measured by its direct application to the interests of the industry whose problems first called for it.

From the earliest times agriculture and brewing have been associated. The quality of beer is directly dependent on that of the raw materials which go to its manufacture, and these are entirely agricultural products. Hence one most important

aspect of brewing research, that directed to the improvement of its raw materials, must affect agriculture as closely as it does brewing. This was recognized at the commencement of the Research Scheme, and the lines of investigation first decided upon were directed to such problems. Three branches of agriculture came directly under review : the cultivation of barley, of hops, and the production of timber suitable for cask making.

It will be particularly interesting to direct attention here to the first two and to their application to British agriculture.

Barley Research.—The barley sub-committee were particularly fortunate in securing the interest of Sir John Russell, under whose capable direction this branch of the research work has been carried out from the commencement. Centred at Rothamsted, it has been pursued with greater results and possibilities than would have been possible elsewhere. Both this work and that on hops has also been looked upon at all times with favourable interest by the Ministry of Agriculture—an association which has been of inestimable value. The problem before this committee has many aspects, some of them directly connected with the technology of brewing, and some which, if carried to a successful conclusion, should have results as valuable to agriculture as to brewing. Of the latter, those first taken in hand by Sir John Russell were directed to ascertain the influence of soil, season and manuring on the yield and quality of barley.

The actual interest of brewers is to obtain the most suitable barley for malting and brewing ; that of the farmer is to obtain the greatest yield of the highest quality. In consequence, it became necessary to decide to what extent good quality and high yield could simultaneously be obtained, and to ascertain in what way, if any, the two were incompatible. The definition of quality presents many baffling problems, and it must be admitted that farmers are at a great disadvantage through the inability of brewers to give them sufficiently clear guidance on that matter. Though brewers and maltsters are generally able to tell by physical appearance what barleys are suitable for their use, and can discriminate between offered samples with sufficient certainty to ensure the success of their subsequent operations, the selection is based on personal experience, and it is impossible to give to others without that experience the desired, definite reasons for their selection. One of the objects of the barley research is to establish tangible criteria of quality. If and when such are found, they will be

of the greatest interest to farmers. At present the nitrogen content of barley offers the most useful single criterion of quality, and it has been largely used in the consideration of the effect of manurial treatment.

Previous to these investigations there was a considerable amount of uncertainty in regard to the best manurial treatment for barley, and the permissible limits for nitrogenous manures. That great yields could be obtained by suitable treatment was, of course, known, but there was a general reluctance to make full use of nitrogenous fertilizers on account of the belief that quality was thereby impaired. The matter could be settled only by very carefully arranged and controlled manurial trials, by valuation and analysis of the barley produced, and by actual malting and brewing trials with large bulks grown under different conditions, when the most suitable treatments had been decided upon by the smaller field experiments. This research was obviously a matter of as great interest to farmers as to brewers. It was only through the co-operation of farmers that the field trials could be made, and the Institute of Brewing is as indebted to the many farmers, in every barley district, who carried out the trials, as the farmers are to the Institute of Brewing for organizing the scheme of research.

The results of this joint work are considered to be of great value. On them the manurial treatment of barley has been recast, and the results are used as the basis for instructions on this matter issued by County Agricultural Authorities. Broadly, it was found that in most localities an increased yield could be obtained by the application of 1 cwt. of sulphate of ammonia per acre without any appreciable reduction in market value or in the quality of the malt and beer produced. Arising from this general finding is the application of nitrogenous and other fertilizers to the varying conditions of different localities, to different varieties of barley, and their probable effects as influenced by variations in climate and weather. These questions are still under investigation, and it will be evident that the Barley Research of the Institute of Brewing, when carried over many years to a complete issue, should be of the greatest value to farming. The field trials have provided extended opportunities for testing new nitrogenous fertilizers, among others ammonium muriate. This fertilizer has given distinctly promising results, and it is understood that it is producible at least as cheaply as, if not more cheaply than, ammonium sulphate.

The question of fertilizers is only one of the aspects of this

research. Others of direct interest to farmers are concerned with the selection and distribution of the barleys which extended trials prove to be most profitable to the grower and most suitable for malting and brewing. Every farmer knows what a change has come about during the present generation in the varieties of barley grown. This development has been due partly to the individual work of such men as Dr. Beaven, the producer of the well-known Plumage-Archer, and partly to co-operation between agricultural authorities and brewers, as in the case of Spratt-Archer produced by Dr. Hunter with the Irish Agricultural Department and Messrs. Guinness. The trial, selection and distribution of pure seed of good varieties is largely the work of the National Institute of Agricultural Botany, but with it is closely associated the Institute of Brewing, which supplies the technical malting and brewing knowledge necessary for the appreciation of the quality of the kinds under trial. Maltsters are deeply concerned in obtaining large bulks of grain of the same variety, as mixture of different races greatly increases their difficulties and depreciates the even quality of the malt they produce. In consequence, the discovery or production of varieties of high malting quality and good cultural characteristics, and the distribution and cultivation of the fewest number of such varieties compatible with the different conditions of soil and climate found in various parts of the country, is work of the utmost value, which can be satisfactorily carried out through the co-operation of growers and users.

Hop Research.—Hops have a peculiar interest in agriculture and brewing, bearing no relation to the quantity grown or used in comparison with barley. They take such an important place in the agriculture of the districts in which they are grown, and require such unremitting attention, that growers are as alive to the value of research on varieties, manurial treatment, cultivation and disease prevention as are brewers, who depend on hops for the flavour and aroma of beer and use them to ensure its stability. These two aspects of the value of hops in brewing led the Hop Research Sub-Committee of the Institute of Brewing to divide their investigations into two main divisions. One had at the outset a preponderatingly chemical aspect and was placed under the direction of Professor F. L. Pyman, a specialist in the chemistry of plant products. Under his inspiration, and later under that of Dr. T. K. Walker, investigations on the preservative principles of hops have been carried on since 1920 at the College of Technology, Manchester.

The other main division of the investigations, with a more immediate appeal to hop growers, was as naturally centred at the South Eastern Agricultural College, Wye, and at East Malling Research Station, as those on barley were at Rothamsted. Under the direction of Professor E. S. Salmon and Mr. A. H. Burgess these investigations have been largely complementary to those instituted by the College itself, and their value is sufficiently appreciated by growers, to whom Wye has become a centre of information and instruction.

The investigations on the purely chemical and brewing sides have already had a very important direct effect on the cultivation of hops. They were instituted at a time when the hop gardens were being replanted after the war, and when it became necessary to decide on the varieties of hops that should be preferred for this purpose. Brewers were not in a position to give sufficiently definite information to growers on the most suitable kinds of hops to plant, and without that lead there was a natural tendency among the latter to consider first the cultural and cropping characteristics of the available varieties. It, therefore, became necessary to decide as quickly as possible whether the hops which would be selected for these qualities were as suitable for brewing as some of the more delicate varieties, the aroma of which was certainly better. These commanded a higher price on the market, but the premium was frequently insufficient to make their cultivation a paying proposition in comparison with the heavy croppers.

In order to provide definite information for growers and brewers, it was decided to carry out a very detailed research on the preservative principles of hops, and to test the relative brewing value of different varieties by very carefully controlled brews at breweries under ordinary trade conditions. As a result the workers at Manchester have greatly increased our knowledge of the substances which give hops their preservative value, and have elaborated methods by which samples of hops can be analyzed and compared from this point of view. The brewers, on their part, were soon able to establish the fact that certain of the prolific varieties—among them the Tolhurst—were of little value to them in comparison with other kinds. This has led to very important results in hop cultivation. Instead of the threatened increase in acreage of hops which, from a brewing point of view, are inferior, however desirable they may be from the cultivation aspect, this has been restricted, and greater attention given to hops of higher class.

Further, it has been possible very closely to associate the Manchester work and the large-scale brewing trials with the special investigations of Wye College and the East Malling Research Station on the production of new and improved varieties of hops. At a time when Wye had neither the ground nor the facilities for testing out Professor Salmon's new seedlings, East Malling undertook the work on a typical hop soil. During the past 15 years, 178 new varieties have been grown side by side with the principle commercial varieties. Each variety has been picked and dried separately, green and dry weights taken and samples prepared, both for chemical analysis and judgment of appearance in the Borough Hop Market, whilst each important variety has been separately packed to enable large-scale brewing trials to be carried out. Mr. J. Amos, of the East Malling Station, has been responsible for collecting this immense amount of data, which has been handed to Professor Salmon for his Annual Reports. These efforts to breed new varieties of hops have a direct bearing on the encouragement of British agriculture. It has been the custom of brewers to import hops from America and the Continent because such hops usually have a higher preservative value than British hops. They have, at the same time, special and much more marked flavouring power than the more delicate English hops which, generally, makes it impossible to brew with them alone. One of the chief objects of the hop breeder, therefore, is to obtain new varieties by crossing, say, American and English varieties, so that the high preservative value of the American and the delicate flavour of the English shall be combined in the progeny. Very considerable success has followed, and already new varieties with high preservative value and good flavour are available. Before such new varieties can be put out to general cultivation it becomes necessary to submit them to very stringent brewing trials over a number of years. This is done by the Institute of Brewing through its association with well-known brewers, and is recognized as a very important factor in the scheme of work.

The menace of various hop diseases has induced the authorities of Wye College to devote great attention to means of prevention, and to breeding varieties resistant to these diseases. The Institute of Brewing has shared to a minor degree in this work also by providing assistance when the pressure of work has been too great for the specialists engaged therein. So disastrous are outbreaks of mould and mildew that there is perhaps no phase of hop investigation of greater

importance to brewing and agriculture than that directed to the production of immune or resistant varieties.

Hop drying is almost entirely an empirical art depending for its success on the experience of the man in charge. In addition, the methods employed are wasteful in fuel and labour. Hop growers would be greatly benefited if modern methods of drying could be applied to this most important part of their operations, and it is possible that the brewing value of hops might be enhanced by improved processes. Steps have, therefore, been taken by the Institute of Brewing, in co-operation with Wye College, to place hop drying on a sounder and more scientific basis. For this purpose an experimental oast was erected at Paddock Wood, and a great deal of valuable information has been gathered there. This installation has already proved of very considerable service to growers, many of whom visit it during the drying period for the discussion of problems which they have encountered at their own oasts, and for advice on points of technique. It is not too much to hope that the methods of hop drying will be greatly improved as a result of the investigations and experiments which are being carried out at Paddock Wood.

Improvements in the methods of packing hops are also being considered with the object of discovering whether the advantages derivable from tighter packing of hops warrant changes in the methods now generally adopted. These investigations are yielding very promising results and go far to show that the usual English pocket is far from the best package for hops.

This short review of the barley and hop researches of the Institute of Brewing is sufficient to show that some of the problems which face farmers and brewers are closely associated, and that their solution is of importance to both industries. It is impossible to deal with barley and hops in a sectional manner. Agriculture and brewing are equally interested in producing the best in the most economical way and to this end each must have as full a knowledge as possible of the difficulties or requirements of the other. This can be achieved only by close co-ordination of the researches initiated by either interest. The Institute of Brewing fully recognizes the cordial co-operation it has always received from agricultural authorities, and in designing the various researches to which its funds should be applied has always felt that the interests of the industry which it represents are best served when those of its parent, agriculture, are studied. It is well repaid if some small contribution is thereby made to the prosperity of agriculture in this country.

LIVE STOCK IMPROVEMENT SCHEME :

REPORT FOR THE YEAR ENDING MARCH 31, 1929

THE Live Stock Improvement Scheme has been in operation since 1914 and its object, scope and procedure are now fairly well known and appreciated by the farming community. Under the Scheme financial assistance is given by the Ministry to Societies, and in connexion with pig breeding to individuals, to encourage (1) the provision of approved pure-bred sires for service at low fees, for the benefit of small farmers and small holders, and (2) the recording of the milk yields of cows, with the object of improving the quality of the ordinary farm live stock of the country. Grants are made to assist in the provision of pedigree bulls, boars and heavy stallions in all parts of England and Wales, and similar grants are made in Wales also in respect of a limited number of Welsh Mountain rams. Since the Scheme came into operation progress has been recorded in each section practically every year—indicating that the Scheme was originated on sound lines and that its results have been beneficial to those farmers who have been prepared to take advantage of it. During the year ended March 31, 1929, there were further increases in the number of premium bulls, boars and heavy stallions, but the membership of milk recording societies showed a decrease for the first time since official milk recording was commenced.

Bulls.—The number of bulls available for service under the Scheme during the year ended March 31, 1929, was 1,408, or 36 more than in the preceding year, and the average number of services per bull was 63.

BULL SCHEME

NUMBER OF BULLS SUBSIDIZED EACH YEAR SINCE THE COMMENCEMENT OF THE SCHEME

<i>Year</i> (Apr. 1-Mar. 31)	<i>No. of</i> <i>Bulls</i>	<i>Year</i> (Apr. 1-Mar. 31)	<i>No. of</i> <i>Bulls</i>
1914-15*	497	1922-23	947
1915-16	633	1923-24	978
1916-17	659	1924-25	1,069
1917-18	710	1925-26	1,175
1918-19	721	1926-27	1,287
1919-20	675	1927-28	1,372
1920-21	668	1928-29	1,408
1921-22	847		

* Including the period February 1, 1914, to March 31, 1914.

In considering the above figures it should be remembered that the beneficial results of the Scheme are not confined to

the 70,000 or 80,000 calves born each year which have been sired by the premium bulls. The effect on the quality of the cattle of a district where premium bulls have been located for some time is cumulative, successive generations showing further improvement. A good number of farmers are grading up their non-pedigree stock for the Herd Books by using the premium bulls. In addition, Live Stock Officers in their reports to the Ministry frequently refer to the fact that some of the larger farmers who require bulls for the service of their own cows have purchased much better animals than formerly, after seeing the good results attained amongst the cattle of the smaller farmers by the use of the premium bulls. In this way the educational value of the location of good class pedigree bulls in areas where such have not been in use previously is effective outside the confines of the Scheme itself.

Now that the benefits of the Scheme are becoming more generally known, Live Stock Officers have less difficulty in securing the interest of farmers and in forming Bull Societies in those areas where at first little headway could be made. Reference was made in last year's Report to a smallholder in the Eastern Counties who was endeavouring to form a Bull Society in his district, because a heifer he had purchased which had turned out remarkably well had been sired by a premium bull. The sequel is that a Bull Society, consisting of some twenty-seven members, has been formed in the district and a very good bull has been located.

The general quality of the bulls provided under the Scheme may be gauged from the average prices of the bulls as given in the table on p. 445, and the exceptional merit of some of the bulls is indicated by their successes and the successes of their progeny at important shows, as well as by the very good prices realized in many cases. A bull whose sire and dam's sire were both premium animals secured the first prize in the Dairy Shorthorn Association's Class at last year's Royal Show and was afterwards sold at a high figure, while the first prize for yearling Lincoln Red bulls at the Leicester County Show and the prize for the best Shorthorn bull owned by a resident in Gloucester, Hereford and Worcester and exhibited at the Three Counties Show were won by premium bulls. A Devon steer sired by a premium bull secured a first prize at the Smithfield Fat Stock Show.

A Live Stock Officer in Wales reports that several bulls provided by owners for use under the Scheme in his district

have been purchased for export to Argentina and Russia at an average price of £100, while the exporter endeavoured to purchase bulls from four other premium bull owners without success. Three of the bulls exported were replaced by the Prize winning Bulls at the Hereford Sale. Of other reports received from different areas the following may be mentioned. Two nine months' old Devon calves sired by a premium bull realized 65 guineas, the breeder retaining his best bull and best heifer for showing purposes; and a Shorthorn bull sired by a premium bull realized 75 guineas for export to the United States. These are admittedly exceptional cases, but premium bulls and their progeny are regularly in the prize lists at local shows and make good prices at sales, with credit to the Premium Scheme.

Breeds and Prices.—The following table shows the number and prices of the premium bulls according to breeds. The average of the prices of the bulls located under the Scheme on March 31, 1929, was little different from that of the previous year. The increase in the number of Lincoln Red Shorthorn bulls located is again relatively larger than in the case of any other breed, owing to the fact that during the last two years comparatively more new Societies have been formed in the Eastern Counties, where this breed is more prominent, than in other parts of the country.

NUMBERS AND AVERAGE PRICES OF BULLS OF EACH BREED

Breed	1926-27				1927-28				1928-29			
	No.	Average Cost			No.	Average Cost			No.	Average Cost		
		£	s.	d.		£	s.	d.		£	s.	d.
Aberdeen-Angus	3	48	3	4	6	47	1	8	9	48	5	1
British Friesian	2	58	12	6	2	58	12	6	1	47	5	0
Devon	136	54	6	4	146	51	9	0	152	52	9	4
Galloway	1	19	19	0	1	19	19	0	1	27	6	0
Guernsey	12	43	19	11	16	41	5	3	18	39	15	5
Hereford	142	48	4	1	150	47	9	9	156	47	12	5
Lincoln Red ..	141	48	3	10	165	47	15	6	180	47	17	1
Red Poll	—	—	—	—	—	—	—	—	1	42	0	0
Shorthorn	716	52	6	3	752	49	15	1	764	49	8	1
South Devon ..	14	43	2	8	12	46	19	4	10	43	0	10
Sussex	—	—	—	—	3	35	7	0	5	39	11	10
Welsh Black ..	69	45	1	6	69	35	8	5	71	32	9	11
All breeds ..	1,236	50	19	6	1,322	48	10	4	1,368*	48	4	5

* 1,408 bulls were located, but grants in respect of 40 were in suspense at the end of the year.

Service Fees.—The service fees charged for the use of premium bulls again ranged from 2s. 6d. to 10s. 6d. In most parts of England more than half the fees charged are at the rate of 5s. 0d. or less per service, the only counties where more than half the fees are above 5s. 0d. being Cumberland, Northumberland, Durham, Lincoln, Rutland, Isle of Ely and Somerset. Over the whole of England, 72 per cent. of the service fees are 5s. 0d. or less, while, in Wales, the proportion is much higher, viz., 93 per cent., of which nearly half are below 5s. 0d.

Year	2/6	3/0	3/6	4/0	4/6	5/0	5/6	6/0	6/6
1926-27	67	52	34	78	13	691	7	108	3
1927-28	68	51	34	89	12	768	14	108	4
1928-29	62*	53	37	96	10	802	15	118	4

Year	7/0	7/6	8/0	8/6	9/0	9/6	10/0	10/6
1926-27	..	12	140	5	4	1	1	17
1927-28	..	13	138	6	2	—	—	13
1928-29	..	11	132	7	2	—	—	16

Boars.—In the year ended March 31, 1929, there was a further increase in the number of boars available for service under the Scheme. The following table shows the number of boars in respect of which grants have been paid each year.

BOAR SCHEME

NUMBER OF BOARS SUBSIDIZED EACH YEAR SINCE THE COMMENCEMENT OF THE SCHEME

Year (Apr. 1 to Mar. 31)	No. of Boars	Year (Apr. 1 to Mar. 31)	No. of Boars
1914-15	115	1922-23	569
1915-16	193	1923-24	638
1916-17	216	1924-25	655
1917-18	264	1925-26	710
1918-19	350	1926-27	844
1919-20	399	1927-28	907
1920-21	441	1928-29	933
1921-22	550		

Pig prices remained low during 1928 and, as always occurs in such circumstances, the number of breeding sows in the country was reduced. The demand for the use of premium boars was therefore smaller than in the previous year, the average number of sows served per boar being only 54, against 62 in 1927-28. The fact that, in spite of these circumstances, it has been possible for Live Stock Officers to find an additional number of farmers prepared to provide good class pedigree boars for the use of sow-owners in their districts speaks well for the appreciation of the value of the Scheme.

During the year, further reports have been received as to the improvement in the general quality of the pigs in districts

where premium boars have been located. One of these, referring to a district of small holdings in the Eastern Counties, may be specially mentioned. In this case very marked improvement has followed the provision of two premium boars by one owner, as many as 200 sows, the property of 50 persons, being served in a year. The value of breeding from good class boars is also being brought home to breeders by buyers of pigs. In some markets buyers of weaners are reported to inquire before purchase whether the pigs have been sired by a premium boar or a first-class private boar, and a Live Stock Officer in the Eastern Counties states that a large buyer of store pigs recently asked to be informed of the location of the various premium boars, as he expected to find the animals he wanted in such areas. An individual case which is fairly typical may also be quoted. A breeder in the Midlands, who keeps a good type of sow but used a cross-bred boar, recently realized only £4 18s. 0d. for six of his pigs when 8 months old, whereas in the same market four pigs at 6½ months old sired by a premium boar realized £7 15s. 0d. The breeder in question has now disposed of his cross-bred boar and is sending his sows to the premium boar.

Breeds and Prices.—Pedigree boars were purchased at slightly easier rates last year, and the average price of all the premium boars located on March 31, 1929, was £12 17s. 3d.

NUMBER AND AVERAGE PRICES OF BOARS OF EACH BREED

Breed	1926-27			1927-28			1928-29		
	No.	Average Price		No.	Average Price		No.	Average Price	
		£	s.	d.		£	s.	d.	
Berkshire	17	15	9	8	16	14	14	8	22 12 8 8
Cumberland	48	12	5	6	54	12	2	11	54 12 0 8
Essex	2	12	2	6	2	12	2	6	— — —
Gloucester Old Spots ..	7	12	3	5	7	12	3	5	6 13 7 2
Large Black	65	11	10	7	57	11	14	11	47 11 18 7
Large White	462	13	16	1	532	13	14	11	589 13 4 8
Lincoln Curly Coated ..	29	11	9	5	29	10	9	3	27 9 10 6
Middle White	108	12	15	5	105	12	5	7	92 12 6 5
Large White Ulster ..	5	14	17	0	7	15	6	3	6 12 19 2
Tamworth	1	14	14	0	—	—	—	—	— — —
Wessex Saddleback ..	16	12	10	11	9	13	9	9	12 13 7 5
Welsh	48	12	6	1	60	12	12	3	{ 4 10 17 9
Long White Lop-eared.	12	14	1	8					{ 58 13 2 7
All breeds	820	13	4	8	878	13	3	4	917* 12 17 3

* 933 boars were located, but grants in respect of 16 were in suspense at the end of the year.

—a decrease of 6s. compared with the previous year. Large White boars, which are by far the most numerous, averaged nearly £13 5s.—a decrease of about 10s.

As in the previous year, a fair number of applications were received from owners of premium boars to provide Large White boars in place of those of other breeds, as owners of sows in their districts were asking for the change. Consequently, the number of Large White boars provided under the scheme increased by 57, and this breed accounted for 64 per cent. of the total against 61 per cent. in the previous year and 47 per cent. three years ago.

Service Fees.—The service fees again ranged between 2s. 6d. and 10s. 0d. Although there are a few more boars for which a service fee of 10s. 0d. is charged, the general tendency is downward. The number of service fees exceeding 5s. 0d. declined by 2 and those below 5s. 0d. increased by 10. The higher service fees mostly occur in the northern counties.

Year	2/6	3/0	3/6	4/0	4/6	5/0	5/6
1926-27 ..	6	11	21	57	5	543	1
1927-28 ..	4	14	17	49	3	623	1
1928-29 ..	3	12	16	60	6	654	1

Year	6/0	6/6	7/0	7/6	8/0	8/6	10/0
1926-27 ..	70	4	5	91	—	1	5
1927-28 ..	68	2	6	88	—	—	3
1928-29 ..	65	3	4	87	—	—	6

Horse Breeding.—*Heavy Horses.*—The number of heavy stallions hired by Societies receiving grants from the Ministry was further increased in 1928, and the number of mares served by stallions travelled under the Scheme was 10,073 against 7,610 three years previously. It has to be remembered however, that although additional Heavy Horse Societies have been formed in certain areas during the last few years, and more mares have been served by subsidised stallions, there is as yet no evidence that the decline which has been continuous since 1919 in the breeding of heavy horses in the country has been arrested. Last year it was thought that the small reduction of only 100 in the total number of heavy foals in England and Wales in 1927 might indicate that breeding had then reached its lowest point, but in 1928 there was a further reduction of 1,380. The total number of heavy foals in 1928 was only about 22,700, a number which would appear to be inadequate to meet the requirements of farmers and other users of draught horses when these foals arrive at working age, since even now the reduced supply of heavy horses is being felt on the market, although five years ago there were 50 per cent. more heavy foals than last year. The

decline in breeding has naturally led to a decrease in the number of stallions in the country, and in 1928 only 1,033 heavy stallions were licensed in England and Wales against over 2,000 five years earlier.

Representations have been made to the Ministry that the present grants for heavy horse breeding are inadequate, and in view of these representations and the decline in breeding, it has been decided that further encouragement should be given to farmers to breed heavy horses. The direct grants payable to Heavy Horse Societies will therefore be increased next season from £40 to £60 per stallion, and grants will be payable in respect of stallions hired at a fee not exceeding 400 guineas and serving at a fee not exceeding 4 guineas, as compared with the present maxima of 300 guineas and 3 guineas respectively. It is hoped that the increase in the grants will have the desired effect.

HEAVY HORSE SCHEME

<i>Service Season</i>	<i>No. of Stallions</i>	<i>Total No. of Mares served</i>	<i>Average No. of Mares served</i>	<i>No. of Assisted Nominations</i>	<i>Average Hiring Fee of Stallions</i>	<i>Average Service Fee</i>
					£	£ s. d.
1914	72	6,365	68	1,503	231	2 8 6
1915	97	9,122	94	2,430	241	2 9 6
1916	108	9,995	92	2,181	244	2 11 0
1917	110	10,556	96	2,151	258	2 16 3
1918	122	12,281	100	2,165	285	2 15 8
1919	118	10,920	96	1,996	317	3 6 3
1920	105	9,133	87	1,839	345	3 13 1
1921	101	7,888	78	1,943	333	3 13 7
1924	87	6,098	70	*	178	2 7 0
1925	96	7,413	77	1,723	194	2 8 4
1926	98	8,165	83	2,171	208	2 8 6
1927	105	8,950	85	2,599	211	2 8 9
1928	114	9,792	86	2,805	217	2 9 4

* No grant was made by the Ministry for assisted nominations (except to the Cumberland Society) for the service season 1924.

The above figures do not include those relating to the Cumberland and Westmorland Society, which was formed for the purpose of awarding assisted nominations to selected stallions travelled by their owners in these counties. It was again possible in 1928 to award an increased grant to this Society so that more assisted nominations could be issued. The numbers of such nominations issued by this Society each year since its formation in 1915 have been as follows:—

<i>Service Season</i>	<i>No. of Assisted Nominations</i>	<i>Service Season</i>	<i>No. of Assisted Nominations</i>
1915	385	1921	255
1916	394	1924	121
1917	328	1925	197
1918	321	1926	220
1919	264	1927	247
1920	254	1928	281

Horse Breeding Act, 1918.—The number of stallions licensed under the Horse Breeding Act, 1918, in the licensing year ended October 31, 1928, was 1,414, a decrease of 123 as compared with the previous year. It will be seen from the table below that the decline in the number of stallions licensed has been continuous since 1921.

<i>Year (ending October 31)</i>	<i>No. of Appli- cations for Licences</i>	<i>No. of Licences issued</i>	<i>No. of Refusals</i>
1920	4,153	3,749	404
1921	4,060	3,816	244
1922	3,644	3,479	165
1923	2,897	2,761	136
1924	2,285	2,210	75
1925	1,908	1,849	59
1926	1,664	1,608	56
1927	1,574	1,537	37
1928	1,454	1,414	40

Although the number of applications for licences decreased on the year, there was a slight increase in the number of cases in which licences were refused. In 1928, licences were refused in respect of 40 stallions, or $2\frac{3}{4}$ per cent. of the applications, against 37 refusals or less than $2\frac{1}{2}$ per cent. of the applications in 1927, but, apart from 1927, the percentage was the lowest since the Act came into force.

The number of stallions of each breed or type licensed for the 1928 service season, and the number to which licences were refused, are shown in the next table :—

NUMBER OF STALLIONS LICENSED OR REFUSED					<i>Pedigree</i>		<i>Non-Pedigree*</i>	
					<i>Licensed</i>	<i>Refused</i>	<i>Licensed</i>	<i>Refused</i>
<i>Heavy—</i>								
Shire .. ..	..	..	..	..	682	14	38	—
Clydesdale .. ..	..	..	..	..	112	2	8	—
Suffolk .. ..	..	..	..	..	132	8	—	—
Percheron .. ..	..	..	..	..	38	3	—	—
Others .. ..	..	..	..	..	—	—	23	2
Total Heavy					964	27	69	2
<i>Light—</i>								
Thoroughbred .. ..	..	..	..	..	162	5	2	—
Hackney .. ..	..	..	..	..	58	3	5	—
Arab .. ..	..	..	..	..	9	—	3	—
Hunter .. ..	..	..	..	..	3	—	2	—
Cleveland Bay .. ..	..	..	..	..	5	—	—	—
Yorkshire Coach .. ..	..	..	..	..	2	—	—	—
Welsh Roadster .. ..	..	..	..	..	1	—	—	—
Others .. ..	..	..	..	..	—	—	4	—
Ponies (including Welsh Cobs) ..	..	..	..	..	106	2	19	1
Total Light					346	10	35	1
Grand Total					1,310	37	104	3

* Non-Pedigree Stallions are arranged as far as possible under types.

The Thoroughbred was the only breed to show an increase in 1928 in the number of stallions licensed, viz., 164 against 153 in the previous year, but even so, light stallions as a whole showed a relatively sharper decrease than heavy stallions. The reduction in Hackneys was as much as 35 per cent., from 97 to 63, while ponies (including Welsh Cobs) declined from 154 to 125. There was practically no change in the number of Clydesdales licensed, 120 in 1928 against 121 in 1927, but Shires declined by 52 to 720, and Suffolks, which numbered 132, showed a decrease of 7.

The number of stallions rejected for each of the prescribed diseases and defects was as follows:—

Roaring	11	Cataract	4
Whistling	10	Defective genital organs..	1
Sidebone	5	Bone spavin	2
Ringbone	3	Stringhalt	3

Appeals were made against refusals of licences in seven cases, and five of the appeals were successful.

The number of infringements of the Act reported to the Ministry during the season was rather higher than in 1927. Four unlicensed stallions were reported as being travelled, but in one case an application had already been made for a licence. Seven unlicensed stallions were reported as being exhibited for service, but licences had already been applied for in respect of five of them. Proceedings were taken in three cases and convictions were obtained.

Rams.—As in each year since 1919, grants were made in 1928 to a number of Societies in Wales with the object of improving Welsh Mountain Sheep. Twenty-five rams were provided under the scheme, and the number of ewes served was 1,504, or 60 per ram. The hiring fees of the rams ranged from 6 guineas to 12 guineas and the service fees from 1s. 0d. to 3s. 6d.

A new Society was formed last year near the Prescelly range in Pembrokeshire, and it is hoped that this will result in a much needed improvement in the flocks on these hills. Experience in districts where the Scheme has been in operation for some years justifies that hope, as the provision of the premium rams and their mating with carefully selected ewes has led to a decided improvement in the quality of the sheep in the different districts, particularly as regards the texture of the wool.

Milk Recording.—The number of members of Milk Recording Societies showed a decrease in 1927-28, this being the first

appreciable decrease in membership since official milk recording was commenced in 1914-15. There were 5,174 members in 1925-26 and this figure was practically maintained in the following year, but in 1927-28 the number fell to 4,862.

Milk Recording Societies are not alone among the societies connected with agriculture which have seen a reduction in their membership in the last year or two as a result of the general depression in the industry. As, however, the majority of the herd owners who have resigned are reported to record their cows privately, the decreases in the membership of milk recording societies need not occasion any anxiety as to the soundness of the object of the Ministry's milk recording scheme, which is primarily educational.

It is, however, regrettable that the present financial stringency is slackening the rate at which recording is being taken up by cow owners who have not yet had any experience of recording. That this is so is evidence that the benefits to be derived from recording are not yet generally realized; otherwise the depression in agriculture would be an added inducement to undertake recording, as experience shows that when records are properly applied recording proves a profitable investment. In this connexion the following statement made by the Head of the Dairy Husbandry Department of the National Institute for Research in Dairying may perhaps be quoted: "The man who says he has no time to record has not a vestige of right to complain that dairy farming is not paying, because he is obviously ignoring the foundation stone of his business."

It may be useful to state briefly that the benefits to be derived from milk recording are that unprofitable cows are discovered and can be drafted out of the herd; feeding can be carried out more economically; ailing cows are quickly detected; the best cows and bulls from which to breed can be determined; and increased interest on the part of the farmer and stockmen is obtained. Membership of a Milk Recording Society provides the following additional advantages: the society's officers give instruction as to the correct methods of recording, check the records, earmark the cows, assist in obtaining advice on rationing, and take samples of the milk for testing, while forms are provided for the keeping of the records, and the records may be officially certified.

The following table shows the number of members of milk recording societies in each year since 1917-18, when all

Societies adopted a uniform milk-recording year, together with the number of herds and cows recorded :—

(Year ended Oct. 1)	Societies	Members	Herds	Cows
1917-18	27	639	708	19,793
1918-19	38	1,191	1,332	37,880
1919-20	46	2,075	2,312	61,323
1920-21	52	3,328	3,664	97,903
1921-22	55	3,949	4,362	117,023
1922-23	55	4,365	4,767	127,151
1923-24	52*	4,764	5,209	138,086
1924-25	50*	5,081	5,516	148,905
1925-26	49*	5,174	5,656	154,322
1926-27	51†	5,166	5,650	156,847
1927-28	50‡	4,862§	5,320§	149,971

* The decrease in the number of Societies was due to amalgamation.

† The increase in the number of Societies was due to the dividing of one Society covering three counties into separate Societies for each county.

‡ The decrease in the number of Societies was due to a Society ceasing operations.

§ Including 36 members recording goat herds only.

Average Yield of Recorded Herds.—The number of cows recorded under the Ministry's Scheme in 1927-28 was 149,971, of which 77,171 were cows which had been in the recorded herds for the whole of the year. The percentage of full-year cows to total cows recorded has remained fairly steady from year to year since 1921-22, at slightly over 50 per cent. The following table compares the average yield of (1) all cows and heifers recorded, and (2) cows recorded for the full year, for each year since the uniform milk recording year was fixed :—

Year Oct. 1 to Oct. 1	Particulars of all cows and heifers recorded			Particulars of cows recorded for full year			
	No. of cows & heifers	Total yield	Aver- age yield *	No. of cows	Per- centage of total cows & heifers	Total yield	Aver- age yield *
		Gal.	Gal.			Gal.	Gal.
1917-18	19,793	8,426,958	426	8,775	44	5,255,923	599
1918-19	37,880	16,204,941	450	17,989	47	10,543,516	579
1919-20	61,323	29,344,887	479	27,266	44	17,363,347	637
1920-21	97,903	48,512,380	495	48,248	49	30,892,620	640
1921-22	117,023	60,463,617	517	63,318	54	41,208,073	651
1922-23	127,151	67,904,224	534	68,349	54	46,956,565	687
1923-24	138,086	73,963,165	535	73,338	53	50,299,884	685
1924-25	148,905	76,419,498	*513	77,132	51	51,695,291	*670
1925-26	154,322	81,623,788	*529	81,669	53	56,102,434	*687
1926-27	156,847	82,161,809	*524	81,749	52	55,677,261	*681
1927-28	149,971	76,896,131	*513	77,171	51	51,931,633	*673

* Before 1924-25 the average yield was calculated at the equivalent of 10½ lb. to a gallon and subsequently at 10¼ lb.

The average yield of full-year cows in 1927-28 was 6,954 lb. (673 gallons), which showed a small decrease on the previous year. A reduction in the average yield was to be expected owing to the very poor quality of the hay crop of 1927 following the wet summer of that year, and the shortage of grass in the spring of 1928. Decreased average yields were shown by 37 of the 50 Societies, and only three Societies, against six in the previous year, had average yields exceeding 7,500 lb. (726 gallons) per cow. Suffolk with an average of 7,603 lb. (736 gallons) headed the list, being followed by Durham and Essex with averages of 7,572 lb. (733 gallons) and 7,565 lb. (732 gallons) per cow respectively.

Individual herds with average yields for full-year cows of 8,000 lb. or over numbered 944, or 20 per cent. of the herds recorded for the full year, whilst another 1,206 herds, or over 25 per cent., averaged from 7,000 lb. to 8,000 lb. per head for full-year cows. A few examples of the increases effected in the average yields of herds as a result of recording, together with the cash values of the increased yields calculated at the rate of 1s. per gallon of milk, are shown in the following table :—

Herd	No. of years during which records have been taken	Average yield per cow in first year	Average yield per cow in last year	Increase in annual average yield per cow	No. of full-year cows in last year of period	Cash value of increase of last year over first year at 1s. per gallon	
						per cow	per herd
		Gal.	Gal.	Gal.		£ s.	£ s.
A. (Pedigree Friesian)	7	634	1,173	539	13	26 19	350 7
B. (Pedigree Shorthorn)	6	512	898	386	11	19 6	212 6
C. (Non-Pedigree Shorthorn)	7	563	970	407	12	20 7	244 4
D. (Non-Pedigree Shorthorn)	5	690	951	261	11	13 1	143 11

In the next table are given particulars of the number and average yield of milk of recorded cows of the different breeds in 1927-28. A certain number of cows of other breeds are recorded, but similar information regarding these is not included in the table as it would be of little practical value

and might be misleading in view of the small number of cows concerned. Most breeds had lower average yields than in 1926-27, South Devons and Ayrshires being the only breeds to show increases, while Devons and Red Polls gave average yields which were practically unchanged on the year.

As regards the number of cows of the different breeds recorded, Shorthorns accounted for 63 per cent., Friesians coming second with 15 per cent., followed by Guernseys with nearly 5 per cent. and Red Polls and Jerseys with over 3 per cent.

TOTAL NUMBER OF COWS AND HEIFERS OF CERTAIN BREEDS RECORDED IN ENGLAND AND WALES DURING THE YEAR ENDED OCTOBER 1, 1928, AND THE NUMBER AND AVERAGE YIELD OF COWS RECORDED FOR THE FULL YEAR, TOGETHER WITH THE PERCENTAGE OF FULL-YEAR COWS.

Breed or type	Total number of cows and heifers recorded	Particulars of cows recorded for full year			
		Number	Percentage of total cows and heifers	Total yield	Average yield
				lb.	lb.
Ayrshire ..	2,405	1,218	50.6	8,654,899	7,106
Blue Albion ..	1,494	863	57.7	6,249,697	7,242
Devon ..	1,506	853	56.6	4,746,581	5,565
Friesian ..	22,664	12,027	53.0	97,865,697	8,137
Guernsey ..	7,285	3,279	45.0	20,563,161	6,271
Jersey ..	4,963	2,380	47.9	14,605,724	6,137
Lincoln Red ..	2,955	1,583	53.5	11,013,764	6,958
Red Poll ..	5,091	2,989	58.7	20,279,281	6,785
Shorthorn ..	94,790	48,576	51.2	331,828,878	6,831
South Devon ..	2,529	1,182	46.7	7,398,182	6,259
Welsh Black ..	1,080	595	55.0	3,329,957	5,597

Issue of Certificates.—The number of Certificates of Merit issued during the year under review was much the same as in the previous year, being 255 as compared with 266. Certificates of Merit cover a period of three consecutive milk-recording years, and are only awarded in respect of cows which have given not less than the prescribed yield of milk for their breed or type and have been regular breeders during those years, so that such a Certificate is a proof of a cow's good milking and breeding qualities over an extended period.

Of the 255 Certificates of Merit issued for the period ended October 1, 1928, 105 were in respect of cows which yielded 30,000 lb. or over of milk during the three-year period. This number included 40 Shorthorns, 23 Friesians, 19 Red Polls and 10 Guernseys. The highest yields certified for the three

years were 63,226½ lb. and 42,039½ lb. given by pedigree Shorthorns, and 46,615 lb. given by a pedigree Friesian.

Applications for Milk Record Certificates, which show the record of a cow for a single year only, continue to decline in number and only 61 such certificates were issued for the year ended October 1, 1928, as against 121 for the previous year.

Register of Dairy Cattle.—Owing to the decrease in membership of milk recording societies and the lower yield of cows generally in 1927-28, the number of cows which qualified in the milk-recording year ended October 1, 1928, for entry in Volume XII of the Ministry's Annual Register of Dairy Cattle, which was published on June 15, 1929, was smaller than in the previous year, being 13,539 against 15,558. Shorthorns accounted for 56 per cent. of the total number eligible for entry, as compared with over 60 per cent. in the previous year, and the number of Shorthorns which reached or exceeded the standard for their breed, viz., 9,000 lb. of milk in the year, declined from 9,559 in 1926-27 to 7,645 in 1927-28. Friesians showed a comparatively small decrease, 3,005 cows of this breed giving the standard of 10,000 lb. of milk or over in 1927-28, as compared with 3,067 in 1926-27. Ayrshires with 266 eligible cows and Red Polls with 495, especially the former, showed appreciable increases on the year. Of the total number of cows which qualified for entry, 7,652 (or 56 per cent.) gave yields of 10,000 lb. or over.

The number of entries in the Register was again limited to 7,500 cows, so that only about 55 per cent. of the eligible cows of each breed were included in Volume XII. Of the cows entered, 6,312 yielded 10,000 lb. or over, while 1,804 yielded 12,000 lb. or over, of which 224 gave between 15,000 lb. and 20,000 lb. and 19 over 20,000 lb. in the year.

A separate section of the Register gives particulars of the 255 cows in respect of which Certificates of Merit were awarded for the three-year period ended October 1, 1928.

A further increase is shown in the number of bulls entered in this Volume, 122 bulls being included as against 99 in Volume XI. Bulls which are entered for the first time total 23, of which 17 qualified under the requirement that their dams and sire's dams have given not less than the standard yield prescribed for their breed or type; and 6 are entered as having two or more daughters which have given not less than the prescribed yield. The total number of bulls entered by reason of the milk records of their dams and sire's dams

is 80, while 42 are entered on the records of their progeny.

Rationing.—Advice on the feeding and management of live stock may be obtained by farmers in all parts of the country from County Agricultural Organizers or other authoritative sources, and many members of Milk Recording Societies make increasing use of the facilities thus provided. There is perhaps no direction in which the keeping of milk records is of more practical value to an owner of cows than in affording information necessary for the economical rationing and improvement in the system of feeding of his cows, and it is therefore satisfactory to record that reports from Live Stock Officers indicate that the records are largely used in this connexion.

Testing for Butter Fat.—In spite of the reduction in the number of herds recorded by Milk Recording Societies in 1927-28, more samples of milk were taken by Recorders for testing for butter fat than in the previous year. About 110,000 samples were taken of the milk of individual cows, and the total number of samples, including those of the mixed milk of herds, was 128,526—an increase of 16,350 on the year. As the testing of milk for butter fat is optional under the Ministry's Milk Recording Scheme, these figures afford evidence that members of Societies are taking an increasing interest in the quality of the milk produced by their cows. Live Stock Officers report that it is not unusual for cows giving milk of low butter fat content to be weeded out of herds on this account, and such action is all to the good in tending towards an improvement in the general quality of the country's milk supply.

Calf and Bull Marking.—The extent to which advantage is taken of the Ministry's scheme for the registration and marking of calves of milk-recorded cows varies considerably in different parts of the country. The Cumberland and North Westmorland Society, which recorded a total of 1,908 cows, marked 559 calves, while the Yorkshire Society, with 2,374 cows recorded, marked only 21 calves. The Cumberland and North Westmorland Society is exceptional in that a large proportion (over 40 per cent.) of the calves marked are males, whereas as a rule comparatively few male calves are marked. The total number of calves marked in 1927-28 was 13,944, of which fewer than 1,100 were males, against 15,947 in 1926-27. Forty-nine bulls being used for service and owned by members of Milk Recording Societies were marked during the year under review.

MILK RECORDING SOCIETIES

Statement giving particulars of the 50 Milk Recording Societies operating during the Year ended October 1, 1928.

(The Societies are arranged in order of total number of animals recorded.)

Society	*No. of members	*No. of herds	Total No. of cows recorded	No. of cows recorded for full year	Average yield of cows recorded for full year
					lb.
Essex County	218	254	10,090	5,226	7,565
Hampshire	218	245	8,266	4,598	6,652
Somerset & N. Dorset	236	271	8,172	4,487	6,740
Suffolk	245	270	6,930	4,041	7,603
Norfolk	222	246	6,763	4,105	7,489
Berkshire	157	188	6,523	3,423	6,725
East Sussex	187	219	6,490	3,315	6,656
North Wilts	119	143	6,299	3,557	6,432
Hertfordshire County	157	188	5,621	2,591	7,057
West Sussex	138	156	5,064	2,507	7,177
Kent	148	166	4,759	2,353	6,852
Dorset	79	105	4,500	2,823	6,567
Surrey	142	150	4,061	2,061	6,841
Warwickshire	146	153	3,901	1,803	6,880
Oxfordshire	108	114	3,601	1,760	7,151
Lancashire County ..	111	117	3,547	1,290	6,926
Leics and Rutland ..	119	124	3,272	1,544	6,686
Gloucestershire ..	104	114	3,104	1,761	7,031
Shropshire	77	83	3,021	1,572	7,220
South Wilts	45	58	2,551	1,625	7,113
Buckinghamshire ..	91	96	2,506	1,282	7,187
Cambridgeshire & Dist.	82	91	2,440	1,131	7,417
South Devon and Dist.	102	108	2,436	1,126	6,337
Yorkshire	106	112	2,374	975	7,084
Bristol & N. Somerset	100	105	2,334	1,190	6,692
Derby and District ..	65	67	2,310	1,047	7,282
Staffordshire	73	75	2,249	1,125	7,258
Cheshire County ..	66	70	2,212	1,062	7,225
Northamptonshire ..	84	92	2,174	985	6,874
Cumberland and North Westmorland ..	108	109	1,908	844	5,488
Nottinghamshire ..	53	54	1,724	674	7,202
Worcestershire ..	74	75	1,629	896	6,952
Bedfordshire	52	54	1,543	796	7,377
Northumberland ..	62	63	1,438	663	7,184
Lincolnshire	46	49	1,409	757	7,021
Durham County ..	52	56	1,392	450	7,572
East Devon	77	77	1,345	684	6,665
Peak (Derby)	63	64	1,261	541	7,031
Denbighshire and Flint	47	50	1,117	633	6,645
Monmouth and Brecon	51	51	1,111	472	6,481
Herefordshire	44	45	1,048	533	7,184
Cornwall	64	65	1,047	557	6,302
Kendal and South Westmorland ..	48	49	1,015	384	5,638

Anglesey and Carnar-					
vonshire	63	63	731	431	5,652
Glamorgan	49	49	666	331	7,024
Campden, Moreton and					
District (Gloucs.) ..	28	29	582	352	6,788
Cardiganshire	42	42	478	276	6,049
Carmarthenshire	25	26	471	249	6,550
Montgomeryshire	18	19	280	165	6,224
Pembrokeshire	15	15	206	118	6,268
TOTALS ..	4,826	5,284	149,971	77,171	6,954

* Goat herds are not included.

Cost of Milk Recording.—It is not to be expected that the cost of milk recording should show any appreciable variation from year to year so long as the general procedure remains unchanged, but throughout the last six years the average cost per cow has declined slowly. In 1921-22, the average cost to the Society was 6s. 9d., and to the member 4s. 11d. per cow, but in 1927-28 these figures had been reduced to 6s. 3d. and 4s. 3d., respectively. The cost to the member varies in the different Societies from a little under 3s. to about 7s. per cow, the lower figures generally occurring in counties where the average size of the herds is large. As the cost of recording a small herd is much the same as in the case of a large herd, appreciable variations in the average cost per cow in the different Societies are unavoidable. The grants paid to Societies by the Ministry average rather over 2s. per cow recorded.

Export of Live Stock to Countries Abroad.—Most countries have special regulations governing the importation of live stock, and intending exporters from this country can obtain from the Ministry information on the regulations in force at the time in any particular country. In many cases not only is a certificate required that the animal to be exported is healthy, but a further certificate must be furnished to the effect that the district from which the animal comes is free from certain diseases. The latter certificate is furnished by the Ministry, and the number of such certificates issued during the year ended March 31, 1929, was 977, against 932 in the previous year.

The opening of the Quarantine Station at the London Docks in April, 1928, has led to important changes in the regulations of certain Empire countries, and cattle, sheep and pigs may now be exported, *via* the quarantine station, to the Union of South Africa, South-West Africa, Northern and Southern Rhodesia, Kenya, Australia, Trinidad, the

Irish Free State and Northern Ireland. The frequent prohibitions on such exports, imposed by most of these countries in recent years as a result of the outbreaks of foot-and-mouth disease, will thus be avoided.

The number and declared value of cattle, sheep and pigs exported for breeding purposes from Great Britain and Northern Ireland to each country abroad are published each quarter in the JOURNAL OF THE MINISTRY OF AGRICULTURE. The following table shows the total exports (exclusive of those to the Irish Free State) for the calendar years 1927 and 1928 :—

1928				1927			
No.				No.			
				Value			
				£			
Cattle	..	..	..	1,152	115,185	1,015	161,583
Sheep	..	..	..	3,044	54,539	1,986	41,915
Pigs	..	..	..	340	8,477	322*	6,376*

* Revised figures.

The following memoranda, which give detailed information concerning the live stock operations of the Ministry, can be obtained (single copies free of charge) on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1 :—

Leaflet 282 : " Scheme for Improvement of Live Stock."

Leaflet 146 : " The Value of Records of the Milk Yields of Cows."

No. 609/T.L. : " Bull Grant Regulations."

No. 392/T.L. : " Milk Recording Regulations."

No. 466/T.L. : " Boar Grant Regulations."

No. 89/T.L. : " Heavy Horse Regulations."

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IMPERIAL AGRICULTURAL BUREAUX

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THE system of Imperial Bureaux for the centralization and distribution of information on agricultural subjects (among others) has recently received considerable expansion as a result of the recommendations of the Imperial Agricultural Research Conference, 1927. It is the purpose of this article to trace the steps which have led to the present stage of development and to describe the new organization.

The Bureau of Hygiene and Tropical Diseases.—Imperial Bureaux of use to agriculture had their origin in action taken by the Colonial Office in 1908 and 1909. In 1908 that Department established the Sleeping Sickness Bureau for the collection and dissemination of information respecting African Sleeping Sickness to medical officers in the Colonies and Dependencies concerned and to investigators engaged in research. In 1912, the scope of this Bureau was widened to embrace all diseases in the tropics both of men and of domestic animals, and it became the Tropical Diseases Bureau. A further development took place in 1926 when, with the publication by the Bureau of a new bulletin of hygiene, its name was changed to the Bureau of Hygiene and Tropical Diseases. The main function of the Bureau as regards tropical diseases is to collect from every possible source information concerning their progress, recognition, prevention and treatment; to collate, condense and where necessary translate this information and to render it accessible to investigators, and to medical and veterinary officers in the tropics with as little delay as possible. The three serial publications of the Bureau are the *Bulletin of Hygiene*, the *Tropical Diseases Bulletin* (both issued monthly) and the *Tropical Veterinary Bulletin* (issued quarterly). The two former are concerned chiefly with man, but deal fully with those diseases that are shared by man and his domestic animals; the *Tropical Veterinary Bulletin* concerns itself entirely with veterinary science. It is intended that this last-named Bulletin shall be taken over in due course by the newly established Bureau of Animal Health (*see below*). Apart from these publications the Bureau has a valuable library which is open to medical men and others who come to this country from other parts of the Empire. The Bureau is maintained by a grant from Imperial funds and from funds provided by Dominion and Colonial Governments; contributions are also received from the Sudan and certain Indian

Provincial Governments. The Bureau is under the control of an honorary managing committee appointed by the Secretary of State for the Colonies. It is housed in the premises of the London School of Hygiene and Tropical Medicine.

The Bureau of Entomology.*—The second of the Imperial Bureaux of service to agriculture had its origin the year after the Bureau first described. In 1909, the Colonial Office set up the Entomological Research Committee to further the study of entomology in tropical Africa. In 1913, the scope of the Entomological Research Committee was extended to cover other parts of the Empire, and the Committee was merged into a new Imperial Bureau of Entomology. Contributions are received by the Bureau at the present time from the British Treasury and from practically all the countries of the Empire. The Bureau issues three publications: *The Bulletin of Entomological Research*, containing original articles on economic entomology; *The Review of Applied Entomology*, which reviews all current literature on economic entomology throughout the world and is published in two series (a) dealing with insect pests of cultivated plants, and (b) dealing with any insects, ticks, etc., conveying disease or otherwise injurious to man and animals; and *The Zoological Record* (section *Insecta*), which contains annually as complete a record as possible of the literature of the previous year, chiefly from the systematic standpoint. In addition to its work of centralizing and distributing information, the Bureau undertakes the identification of insects. Under its aegis, Imperial Entomological Conferences are held from time to time. In 1926, the work of the Bureau was further extended by the establishment from the Empire Marketing Fund of a parasite laboratory for breeding beneficial parasites for export to various parts of the Empire for the control of insects which are injurious to agricultural plants, stock, etc. The parasite laboratory (the parasite "zoo") is situated at Farnham House, Farnham Royal, Buckinghamshire. The Bureau is administered by an honorary committee of management, the Chairman and members of which are appointed by the Secretary of State for Dominion Affairs and the Colonies. The headquarters of the Bureau of Entomology are housed in the Natural History Museum and the Library and Publication Office are at 41 Queen's Gate.

* Fuller information regarding the work of the Bureaux of Entomology and Mycology and the Royal Botanic Gardens, Kew, will be found in a volume entitled *Facilities for Advanced Study and Research in Agricultural Science and Cognate Pure Sciences in the United Kingdom*, to be obtained, price 1s. net, post free, from the Ministry of Agriculture, 10 Whitehall Place, London, S.W. 1.

The Bureau of Mycology.*—The third Imperial Bureau to be formed was the Imperial Bureau of Mycology, which came into being in 1920 following a resolution passed by the Imperial War Conference in 1918. The funds of the Bureau are obtained from contributions by the Dominions, India, the Sudan, Iraq, and most of the Colonial Dependencies. The British Government does not make any direct financial contribution, but by arrangement with the Ministry of Agriculture and Fisheries the Bureau at present occupies a Government building at Kew, rent free. A new and more commodious building for housing the Bureau is in course of erection near the Herbarium at Kew, part of the cost of which is being met by a grant from the Empire Marketing Fund. For the purpose of dissemination of information, the Imperial Bureau of Mycology publishes *The Review of Applied Mycology*, which gives a monthly survey of all current literature dealing with phytopathology and economic mycology from every part of the world. The Bureau arranges periodical Imperial Mycological Conferences; it undertakes the identification and study of fungous and bacterial plant pathogens; and it maintains a museum of tropical plant diseases, and a lending library for the use of overseas mycologists. Like the Imperial Bureau of Entomology, it is administered by an honorary committee of management appointed by the Secretary of State for Dominion Affairs and the Colonies.

Royal Botanic Gardens, Kew.*—Kew fulfils the functions of a Bureau of Botany in all its aspects. On the economic side it has for many years been actively engaged in obtaining from all parts of the world plants of potential economic value, and in the propagation and distribution of these for experimental cultivation in the Dominions and Colonies. Funds have recently been placed at the disposal of the Ministry of Agriculture by the Empire Marketing Board to enable Kew officers to visit overseas parts of the Empire to advise the Governments concerned on botanical and agricultural problems. A botanical survey of the Empire, the fundamental basis for the development and exploitation of the natural vegetable resources, has been continuously in progress for upwards of three-quarters of a century.

The Governments of India, the Union of South Africa, and the West African Colonies maintain officers at Kew for the study of the botanical problems of these particular areas,

* See footnote, p. 462.

and negotiations are in progress for the interchange of scientific staff between Kew and other parts of the Empire.

Imperial Institute.—The operations of the Imperial Institute must also receive mention. It carries out valuable work (a) by investigating Empire raw materials (plant, animal and mineral) in order to determine their possible uses and value ; and (b) by supplying technical and commercial information relating to such materials. Special Advisory Councils and Committees have been appointed to deal with plant and animal products and with minerals. The Institute publishes a Bulletin which records progress in agricultural, mineral and other industries, with special reference to the utilization of the raw materials of the Dominions, Colonies and India ; it also issues handbooks and other publications on specific products.

The Eight New Bureaux.—The question of the extension of the system of Imperial Bureaux was raised at the Imperial Conference of 1926. The Research Special Sub-Committee of that Conference in referring to the great value of the work of the existing Imperial Bureaux, suggested that further Bureaux of a similar kind might well be established in other sciences, as the need for them is realized and the constituent parts of the Empire agree to their establishment. Again, the Committee on Agricultural Research and Administration in the non-self-governing Colonies, which reported in 1927, thought that the establishment of special Bureaux for plant breeding and soils on lines similar to existing Bureaux would be of great value. As a result of these recommendations, the question of the development of the system of Bureaux was made one of the principal items for discussion at the Imperial Agricultural Research Conference in 1927. That Conference recommended the establishment of three further institutions with the title of Imperial Bureaux : for Soil Science, Animal Nutrition and Animal Health ; and five further institutions on a smaller scale with the title "Correspondence Centres" to deal with animal genetics, agricultural parasitology, plant genetics (crops and herbage plants) and fruit production ; and it also recommended the Centres at which these institutions, with the exception of the Imperial Bureau of Animal Health, should be placed. The Conference considered that the functions of an Imperial Bureau or Correspondence Centre should be to collect, collate and disseminate information of a scientific and technical character ; to reply to inquiries on scientific and technical problems from agricultural departments and scientific workers in any part of the Empire ; and particularly to

facilitate intercourse among groups of workers on closely allied problems. On the other hand, it was not considered that the establishment of additional laboratories for attacking imperial problems should form part of the Bureaux organization.

As regards the administration of these new Clearing Stations, it was recommended that funds contributed for the purpose from the various countries of the Empire should be administered by an authority representative of the contributing Governments. Further, it was recommended that each Bureau should be advised by a technical committee of experts including overseas experts (nominated by the Governments concerned), which should report to the financial supervisory body for the Bureaux.

As a result of these recommendations representatives of the interested Governments met in November, 1928, and drew up a scheme for the establishment of the new Clearing Stations of information, the scheme dealing with the functions and funds of the Centres, the administration of the scheme, the number and location of the Centres, their staffing, accounts, etc., and the rendering of technical advice on the conduct of the Centres by specialists in different parts of the Empire. The recommendations of the Imperial Agricultural Research Conference, 1927, as regards the number and location of the Centres, were confirmed, the Bureau for Animal Health (the location of which was left undecided by the Conference) being placed at the Veterinary Research Laboratory of the Ministry of Agriculture at Weybridge. It was, however, decided to make no distinction in title between the Centres and all the new Centres were designated Imperial Bureaux. These new Bureaux and their location are accordingly as follows :—

NAMES	LOCATION
The Imperial Bureau of	attached to the
(1) Soil Science.	Rothamsted Experimental Station, Harpenden, Herts, England.
(2) Animal Nutrition.	Rowett Research Institute, Bucksburn, Aberdeen, Scotland.
(3) Animal Health.	Veterinary Research Laboratory, Weybridge, Surrey, England.
(4) Animal Genetics.	Animal Breeding Research Department, Edinburgh University, Scotland.
(5) Agricultural Parasitology.	Institute of Agricultural Parasitology, Near St. Albans, England.
(6) Plant Genetics For crops other than herbage plants.	Plant Breeding Institute, Cambridge University, England.
(7) Plant Genetics. For herbage plants.	Welsh Plant Breeding Station, Aberystwyth, Wales.
(8) Fruit Production.	East Malling Research Station, East Malling, Kent, England.

While all were described as Bureaux, however, it was decided to organize the first three Bureaux above for the present on a larger scale than the remaining five. The purposes of Imperial Agricultural Bureaux were defined as follows: "To act as effective Clearing Houses for the interchange of information of value to research workers in agricultural science throughout the various parts of the Empire, and for this purpose they should maintain an index of research being carried out in different parts of the Empire and as far as practicable in foreign countries; they should begin by collecting, abstracting and collating information from all sources bearing on the most important problems under investigation in different parts of the Empire; they should keep themselves informed of the general progress of research work within their respective provinces in different parts of the Empire; and they should in appropriate cases summarize available statistics where these are of importance in connexion with their work."

As regards the distribution of information it was laid down that Bureaux should on request supply information within the scope of their work to officials and advisory officers in all parts of the Empire, and should on request also, where possible, supply information to research workers in the Empire, such information to include bibliographies and photo-stat prints of articles on specific problems. As regards the general distribution of information it was recognized that special monographs would have to be published from time to time and that it might ultimately be found desirable to establish a journal when a Bureau had become fully established. The recommendation of the Imperial Agricultural Research Conference, 1927, that a Bureau should not undertake any laboratory or field work involving expense was confirmed, but it was realized that a Bureau would be in a position to be of service to research workers in various other ways and especially by facilitating exchange of workers and meetings of workers interested in the same problems in different parts of the Empire, and the exchange of experimental material for research purposes; and by supplying information on the best centres for post-graduate study, the best sources of supply of apparatus or equipment, etc.

Funds for the New Bureaux.—An agreement was reached as to the contributions of the Governments of the Empire towards the cost of the new Bureaux.

Executive Council.—As a result of the decisions of the

meeting, an Executive Council for the administration of the new Imperial Agricultural Bureaux has been appointed by the Governments of the Empire on the general lines suggested by the Imperial Agricultural Research Conference, 1927. The Council controls the fund for the Bureaux, and its distribution among them, and supervises generally the work of the Bureaux. The Chairman of this Executive Council is Sir Robert Greig, of the Department of Agriculture for Scotland, and the Vice-Chairman is Mr. F. L. McDougall, of Australia House.

Officers of the New Bureaux.—The head of the Research Institute to which a Bureau is attached has been constituted in each case *ex officio* Director of the Imperial Bureau, and in the case of each Bureau there will be at least one whole-time officer, paid from the Council's funds, who will be the Deputy-Director or the Chief Assistant for Bureau work.

Official Correspondents.—In place of the scheme of the Imperial Agricultural Research Conference, 1927, for technical advisory committees, specialists in the appropriate sciences are to be nominated as official correspondents for each Bureau by the Governments represented on the Executive Council ; and in each country the representative of the Bureau will be the official correspondent to whom the Director of the Bureau may turn for such help as he may require, and from whom he may obtain suggestions regarding the work and activity of his Bureau. It is expected that these correspondents will take a lively interest in the work and functions of the Bureau and facilitate its activities in the interest of the research workers in the Empire as a whole.

The New Bureaux in Operation.—The scheme outlined above has been accepted by the Institutions concerned, and has also received wide acceptance from the different Governments of the Empire. Six of the new Bureaux are now functioning and the remaining two will be established shortly.

The writer is indebted to the directors of the older Bureaux, of Kew, and of the Imperial Institute ; to the Colonial Office ; and to the Chairman and Secretary of the Executive Council for the newer Bureaux for suggestions which have been incorporated in this article.

* * * * *

THE CLYNDERWEN EGG PACKING STATION

Historical.—This Station is the property of the Clynderwen and District Farmers' Co-operative Society. The Society, which has its headquarters at Clynderwen, on the G.W.R. main line from Carmarthen to Fishguard, was registered in 1905. Since that date, it has consistently developed its trade, and now operates three other branches at Clarbeston Road, Narberth and Letterston, so that the trading area at certain points extends to more than 15 miles from the main depot. The Society has built up a large and successful business. The total turnover in the past few years has been in the neighbourhood of £90,000 per annum. From the beginning, the Society has done pioneer work in the marketing of farm produce. It has always handled a certain amount of local grain, but has been chiefly concerned with the sale of butter, eggs and some poultry.

Before the War, the eggs handled by the Society were all candled singly and a certain amount of grading was done for special classes of trade. Owing to the scarcity of labour during the War, candling had to be omitted, except during the season of the year when the more doubtful supplies are customarily received. With the return to normal conditions after the War, the Society developed the technique of this side of its business, and, since 1922, all eggs have been candled over an electric light, and rough grading, with the two-ounce egg as a dividing line, has been practised. The care taken in testing and grading has been repaid by the ease with which supplies have been marketed. The egg department of the Society has been consistently profitable, and the prices it has paid have always been favourable to the producer. The Society is the dominant factor in determining local prices.

The quality of the eggs received by the Society has been uniformly good and there has been little complaint on the score of stale or bad eggs. The fact that testing has been carried out for a number of years has doubtless contributed to this result, for, although no formal method of dealing with poor supplies has been followed, a check has been kept on suppliers and it has usually been possible to bring home complaints to the right quarter. The size of the eggs has been generally satisfactory. For a period after 1914, there was a tendency for the size to diminish, but this has now changed and recent supplies have been of a fair average size.

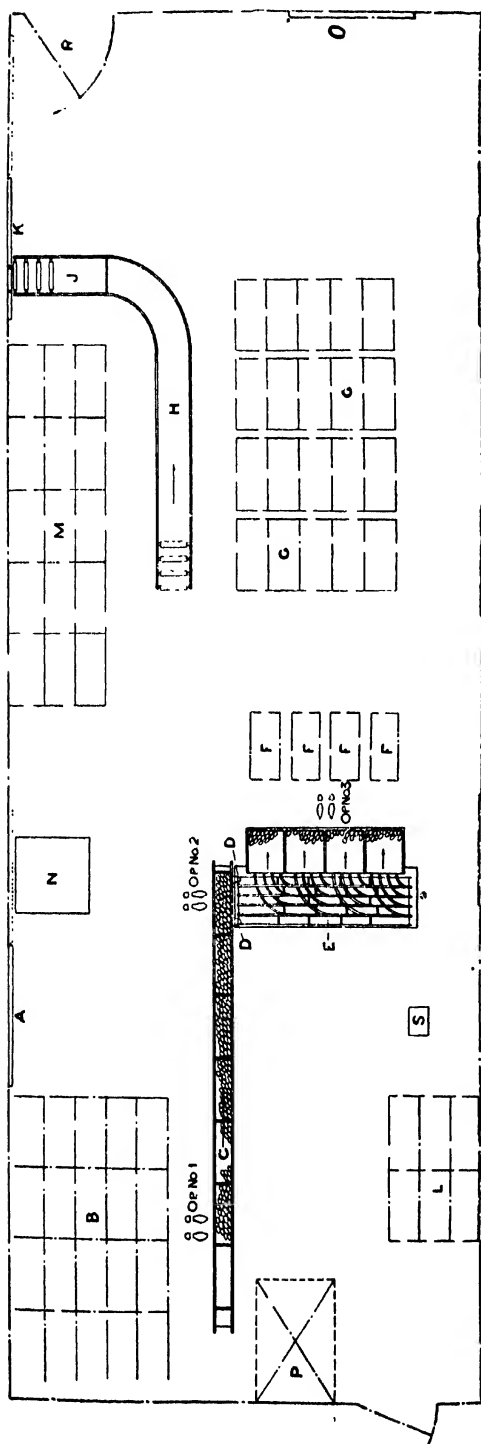


FIG. 1.—CLYNDERWEN EGG PACKING STATION: PLAN OF LAYOUT.

- A. Door (lorry height) for reception of eggs from depots.
 B. File of boxes of eggs as delivered.
 C. Endless belt conveyor controlled by Operator No. 2.
 D. Candling lamps.
 E. "Avery" four-track grader.
 F. Non-returnable cases to take graded eggs.
 G. File of boxes packed ready for dispatch to distributors.
 H. Gravity roller conveyor.
 J. Detachable extension of H.
 K. Door at which vans take up cases for dispatch to distributors.
- L. Stack of non-returnables to replace those filled at F.
 M. Stack of emptied cases ready for handing out when further supplies are received from depots.
 N. Lift to floor above.
 O. Fireplace.
 P. Spiral staircase to floor above.
 R. Door for general entry into building. This door is used for the reception of eggs delivered by farmers to the Station.
 S. Desk for book-keeping purposes.

Operator No. 1 unpacks boxes as received from depots and places the eggs on conveyor (C). This operator also carries the empty cases and stores them at M.

Operator No. 2 controls belt conveyor (C), candles the eggs and places them on grader (E).

Operator No. 3 takes the eggs as graded by "Avery" grader (E) and packs them into their respective boxes at F.

From 1914 to 1928, the total value of the farm produce handled by the Society was £418,000, of which £91,500 consisted of egg sales. The numbers of eggs handled during the past five years have been as follows:—

<i>Year</i>						<i>Number of eggs</i>
1924	..	..	..	..	..	679,426
1925	..	..	..	..	..	676,275
1926	..	..	..	..	..	736,202
1927	..	..	..	..	..	703,296
1928	..	..	..	..	..	935,669

It is confidently anticipated that the egg business of the Society will develop rapidly as a result of its registration as a packing station under the National Mark Egg Scheme.

The New Station and the New Methods.—The new egg-packing station (Fig. 2) is a two-storey, brick-built building with a floor space of approximately 45 by 18 feet. The ground floor is used for the handling of eggs. The top floor, which is connected with the lower by a staircase and electric hoist, is reserved for the storage of packing materials, boxes and for box making. The plan (Fig. 1) shows the general lay-out of the packing floor.

For the time being, eggs will be delivered by producers to the Station itself or to the Society's outlying depots. There will be no collection from farms or markets. Supplies from the depots will be transferred to the Station by motor lorry in wooden cases of the returnable type with fillers and flats.

There are two platforms on the left side of the building, one for unloading and the other—the front platform—for loading the packed cases. The boxes are received from the depots at the door (lorry height) marked A on the plan and stacked at B. An operator (No. 1) unpacks the eggs from the cases and places them on an endless belt conveyor (C); this operator is also available for stacking the emptied cases at M.

The conveyor (C) is controlled by operator No. 2, who candles the eggs, two at a time, with four in each hand, at an "Avery" Daylight candling lamp (D), (Fig. 3), and places them, two at a time, on an "Avery" four-track grading machine (E), (Fig. 4). Eggs that are not of first quality as required by the regulations are rejected by this operator. Each producer's lot is handled separately, the testing and grading analysis of each lot being available so soon as the numbers of eggs in each grade are entered on the card.

Operator No. 3 packs the eggs graded to national standards by the "Avery" grader at F, into their respective cases

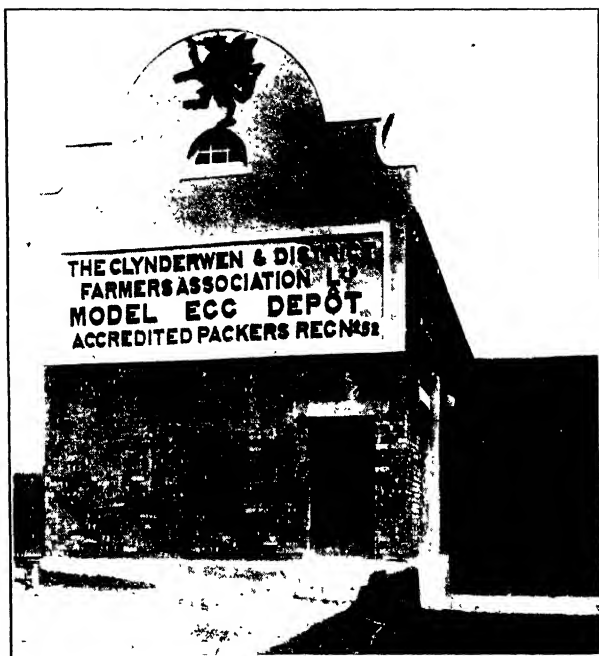


FIG. 2.—Exterior view of the Packing Station



FIG. 3.—Candling, using "Avery" daylight candling lamps

THE CLYNDERWEN EGG PACKING STATION.



FIG. 4.—Grading (“Avery” four-track machine.)



FIG. 5.—Loading packed cases from conveyor on to lorry.

wooden non-returnables of the approved type holding 30-dozen eggs. These cases, as filled, are nailed up and have the National Mark labels affixed. They are then stacked at G ready for dispatch. When a lorry is ready for loading, the cases of graded eggs at G are placed on the conveyor (H) and run right through to the lorry (Fig. 5).

A stock of non-returnable cases is kept at L to replace those filled on the grading machine at F. This stock is replenished, as required, from the floor above, by the lift at N. S is a desk for book-keeping purposes, and R is a door for general entry into the building and for the reception of supplies delivered by farmers to the Station.

The approximate output of the plant is 2,000 eggs per hour, or approximately two 30-dozen cases per operator per hour.

The Society provides a practical illustration on a commercial scale of the improved methods of marketing advocated by the Ministry, and is available as a demonstration centre for Wales and the border counties. By way of reimbursement for the extra expenditure incurred by the Society in equipping itself, in functioning as a demonstration centre and in keeping specially detailed accounts for the Ministry's information, a small annual grant is being made to the Society out of the funds placed at the Ministry's disposal by the Empire Marketing Board. It should be understood, however, that this grant is in respect of services rendered, or expenses incurred, on the Ministry's behalf, and does not, in any way, affect the strictly commercial basis of the Society's operations.

Visits to the Station can be arranged by appointment with the Manager.

The foregoing description of the Clynderwen Egg Packing Station is taken from the Ministry's Marketing Leaflet No. 11. This leaflet is printed in both English and Welsh, and copies of either version can be obtained on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

AUGUST ON THE FARM

J. R. BOND, M.Sc., M.B.E., N.D.A. (Hons.),

Agricultural Organizer for Derbyshire.

Winter Keep.—Recent rains have improved the prospects of the green crop, which is a much better plant than is usually secured in a dry summer, excepting cabbages, which have been badly thinned by the root maggot. Hay crops, however, have been unusually light and, with no surplus carried over from last year and with stunted straw crops, supplies of this class of fodder will undoubtedly require careful management in order to avoid exhaustion before the end of the winter.

In the matter of fodder requirements much depends on seasonal conditions during the winter period. A mild autumn prolongs the growth of grass and turnips and allows of the conservation of fodder supplies; snow and hard frost on the other hand involve heavy calls on the stacks for both sheep and cattle out of doors; while the earliness or lateness of the growth of pasture herbage in spring bring relief from or prolong the hardship of winter foddering. Nevertheless, the farmer can direct his management to the prevention of the worst effects of seasonal adversities. In the first place he can estimate the quantities of long fodder grown and commence strict rationing at the outset—not when supplies are visibly reduced. Straw needed for litter may be chaffed to multiply its effectiveness as an absorbent and thereby permit of the use of part of the straw supply for fodder. It is not unlikely that, after the dry summer, pastures will become green and growthy in the autumn; fields capable of carrying stock in winter, therefore, may well be reserved for late use, the cattle being first confined to those not adapted for out-wintering. Beet tops and similar food material may be fed instead of being ploughed in. Wintering-out is not a means of conserving fodder, unless the cattle have some “roughness” to pull off; but it is worthy of note that straw can be used to good purpose as rack fodder out in the fields. Straw has a value approaching that of hay for heat-production, and cattle wintering out of doors consume it more readily than those warmly housed. In the Eastern Counties, there is generally such an excess of straw available that, even in a year such as this, when corn crops are short, one might rely on being able to buy straw if necessary.

Another resource which farmers might utilize is that of top-dressing grassland for the purpose of shortening the

winter. The use of nitrogenous fertilizers for the production of an early bite might be considered at a later stage : as was observed last spring, hard weather late in the winter seriously retards the early growth intended to be obtained in this way. There remains, however, the practical certainty of being able to promote growth in autumn by means of suitable fertilizers applied in September. For this purpose, fields should be reserved that are suitable for late autumn and winter grazing ; in a hard winter the growth produced would be useful as " pulling " and in a normal winter it would remain fresh and green until spring.

Lastly, catch cropping is worthy of a thought. There is not much land available for sowing in August in the hope of producing autumn keep : the bare fallows are required to be kept free for wheat-drilling about the end of September, and in any case attention may perhaps best be directed to crops producing winter and spring food rather than autumn forage, which may not be so scarce. Where a seed bed can be provided in August, a breadth of hardy white turnips may be sown. If the appropriate variety is sown, capable of withstanding frost, useful tops and—in a mild winter—considerable bulbs, may be grown for feeding in the second half of winter. The land in this case may be cleared in time for oats or barley.

For early spring feeding, and perhaps as the most reliable of all catch crops, rye alone or rye and Italian rye-grass may be recommended. For a good early bite, or a mowing for green feed in April, the seed should be sown on manured land in September, and nitrogenous top dressings should be applied after Christmas. Land intended for bare fallowing might well be devoted to Italian rye-grass alone, thereby providing early grazing without introducing the problem of the effect of the catch crop on the ordinary crop of the rotation.

Minerals on Pasture.—Farmers are familiar with the preference shown by stock for parts of fields where certain mineral top dressings have been applied. Lime, phosphates and even common salt may have a so-called sweetening effect. Permanent or lasting improvements due to the application of fertilizers are commonly associated with a visible change in the botanical composition of the herbage, wild white clover and perennial rye-grass increasing, and bent decreasing in proportion ; there may also be an appreciable alteration in the physical nature of the top layer of soil as the covering of dead fibrous matter rots away. These changes come about gradually,

being spread over one, two or, in the case of liming, three or more seasons. The sweetening effect of top dressings, however, may be almost immediate, suggesting that the mineral constituents in the fertilizers themselves are attractive to the cattle.

A couple of seasons ago, a Derbyshire farmer, who had sought advice on the immediate improvement of a tough pasture, top dressed a field with $1\frac{1}{2}$ cwt. of cyanamide, 3 cwt. of superphosphate and 3 cwt. of kainit per acre. Unintentionally the dressings were applied late in March, and before they had been washed down far into the soil the dairy herd was given access to this in common with certain other grass fields. At the time—mid-April—growth had not begun on the field in question, but the cows displayed a marked preference for the grazing, such as it was, on this enclosure, pulling up and eating the dead fog down to the roots.

In the above case, it was not difficult to understand that the cows at the end of the season of indoor feeding felt a need for mineral matter. The possibility of a similar craving being shown by store cattle that had been on grass for two months, however, was only realized with some surprise. This experience occurred in the present summer. A farmer who is experimenting with considerable originality in the improvement of poor pasture land sought advice regarding the composition of a mixture of minerals which he proposed to feed in a large hopper to heifers and stirks on poorish grassland. One was unable to find a reference to any previous British experiment of this nature, but after perusal of Rowett Institute publications on minerals and consultation with a veterinary colleague, the following prescription was suggested :—

Ground limestone	..	..	..	..	..	40
Sterilized bone flour	..	..	..	..	..	30
Common salt	..	..	..	..	..	10
Potassium chloride	..	..	..	..	..	10
Sulphur	..	..	..	..	..	3
Ferric oxide	..	..	..	..	..	2
Potassium iodide	..	..	..	..	..	0.2

100.2

The mixture was duly made up and put into the hopper in the field, with the unexpected result that the cattle, as soon as they had found what the hopper contained, commenced to scramble for a place at the box and eat the mixture ravenously. The cattleman was alarmed and closed

the hopper. Although some of the animals must have taken at least a pound each, no ill-effects were observed, but it was considered advisable to mix the minerals with fine chaff before opening the hopper again, to prevent a recurrence of the first day's experience.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended July 10.				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	10 13d	10 13d	10 13d	10 13d	13 9
Nitro-chalk (N. 15½%) ..	10 0f	10 0f	10 0f	10 0f	12 11
Sulphate of ammonia:—					
Neutral (N. 20·6%) ..	10 13d	10 13d	10 13d	10 13d	10 3
Calcium cyanamide (N. 20·6%) ..	9 16e	9 16e	9 16e	9 16e	9 6
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%) ..	..	10 10h	..	..	..
Kainit (Pot. 14%) ..	3 6	2 19	2 19	2 17	4 1
Potash salts (Pot. 30%) ..	5 3	..	4 17	4 13	3 1
" (Pot. 20%) ..	3 15	3 9	3 8	3 7	3 4
Muriate of potash (Pot. 50%) ..	9 17	9 3	9 2	8 5	3 4
Sulphate, " (Pot. 48%) ..	11 19	11 6	11 5	10 5	4 3
Basic Slag (P.A. 15½%) ..	2 8c	2 2c	..	2 9c	3 1
" (P.A. 14%) ..	2 3c	1 16c	1 16c	2 4c	3 2
" (P.A. 11%) ..	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26·27½%) ..	2 10||	2 5||	..	2 5a	1 8
Superphosphate (S.P.A. 16%) ..	3 7	..	3 6	3 6	4 2
" (S.P.A. 13½%) ..	3 2	2 15	3 0	3 0	4 4
Bone meal (N. 3½%, P.A. 20½%) ..	8 15	8 10	8 12	8 0	..
Steamed bone flour (N. ½%, P.A. 27½-29½%) ..	5 17b	..	6 10	5 10	..

Abbreviations: N. = Nitrogen; P.A. = Phosphoric Acid; S.P.A. = Soluble Phosphoric Acid; Pot. = Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 80% through standard sieve. a. 85% through standard sieve.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra. Rebate of 1s. per ton will be allowed.

e Delivered in 4-ton lots at purchaser's nearest railway station. Rebate of 1s. 3d. per ton will be allowed.

f Prices for 2-ton lots. Rebate of 1s. per ton will be allowed.

h F.o.r. Goods.

Although little experimental work has been carried out in this country on the use of mineral substances as supplements to grazing, the feeding of bone meal has been found to prevent a number of diseases and troubles due to mineral deficiency in South Africa, America and Scandinavia; and the feeding of iron salts has been found to be beneficial under certain conditions in New Zealand. In Britain evidence has been obtained that differences in nutritive pastures are associated with variations in the mineral composition of the herbage. Godden (Rowett Institute) found that the "eaten" portions of hill pastures were much richer in minerals than the "uneaten," and that poor pasture herbage was always poorer in minerals than in nitrogen. The highest mortality in sheep and the lowest grazing capacity were found on the pastures low in minerals, and whenever sheep have a choice they choose grass high in these constituents. Work on minerals in animal nutrition is in progress at other research stations in this country, and there is reason to believe that in due course it will be possible to give specific advice on the uses of inorganic supplements to cattle on pasture. In the meantime, the above two experiences in Derbyshire suggest that farmers occupying poor grass land might well consider the desirability of cautiously experimenting on the subject.

* * * * *

NOTES ON FEEDING STUFFS

H. G. SANDERS, M.A., PH.D.,

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Grass.—The most pronounced movement in British agriculture in the last ten years has undoubtedly been that away from arable land towards pasture. Much of the land laid down has, of course, been the same that was ploughed up during the War, but it is certain that the net result will be a considerably greater proportion of grass than in pre-war days. This will mean that livestock will play an even greater part in our system of farming than hitherto, for the produce of grass land can only be cashed through an animal of some sort. Whilst the laying down of arable land to grass has always been viewed as a national disaster, in the present case it is being mitigated to a large extent by an increasing tendency to farm pasture better, and to increase its productivity: it is pleasing to be able to notice in passing that science has played a prominent part in this matter.

Some of the most important contributions to our knowledge of grass have been made by the preceding writer of these notes: Dr. Woodman and his colleagues have been carrying out most extensive studies of the productivity of pasture plots, and of the composition and nutritive value of grass as obtained by cutting at various intervals. It is worth noting that they have carried their inquiries right through to the appeal to the animal (to sheep, in point of fact) for a final verdict. The investigations have been planned on a large scale and will take a number of years to complete, but many interesting and useful facts have already emerged. Young grass, it appears, must be regarded as a concentrate, its dry matter having a starch equivalent comparable with that of such foods as linseed cake: it is very rich in protein and its fibre content is low: further, the fibre is very digestible and has a nutritive value equal to that of starch. As grass gets more mature its protein content falls, and the fibre gets more lignified, which means a large falling off in digestibility and nutritive value. So far the interval between cuttings has not been longer than three weeks (except for "control" hay plots), and no falling off in nutritive value has been found with this interval, as compared with one of one week, though the protein content has shown signs of falling: this latter is rather in the nature of an advantage, for, in the early stages of its growth, grass is an unbalanced food for stock in that it contains too much protein.

Perhaps the most striking result is that there is little or no variation in the composition all through the growing season, as long as the grass is kept short—thus the nutritive value of pasture is subject to no appreciable seasonal variation as such, but is determined solely by its condition of growth. It is true that there is a slight depression in its value in times of drought (especially on light soils), but this must be attributed to the fact that under those conditions it makes little vegetative growth, and approaches maturity more quickly. Probably the chief characteristic of a first class pasture is that it contains a good succession of grasses, so that a fair proportion of the herbage is in the early stages of growth throughout a large part of the grazing season. As regards the amount of produce per acre, close cutting undoubtedly lowers the quantity of dry matter obtained, for it means a smaller area of leaf surface, and consequently slower growth. If, however, the comparison is made on the basis of the starch equivalent produced per acre, it is found that plots cut at

weekly intervals produce nearly as much as plots cut as hay and aftermath, whilst they produce considerably more digestible protein. Fortnightly cuttings gave 29·3 per cent., and three-weekly cuttings 62·3 per cent more dry matter than weekly cutting (without lowering of the nutritive value); hence there must be a considerable gain in a system of grazing which gets the grass bitten off at, roughly, monthly intervals. Monthly intervals are being employed in the present season's investigations, and the results will be awaited with great interest, for the usual practice in "rotational grazing" is to allow monthly intervals between stockings. The question is—Will the digestibility of the herbage fall so low that it loses something of its character as a concentrated food, and will the protein content be a nearer approach to that required in a balanced ration?

Prior to these investigations, the management of pasture land was purely an art, for the grazier had no precise knowledge of the value of the herbage his animals were eating, nor of the factors which affected it—and it must be confessed that scientists had not realized what a valuable food it was. With these facts before him, however, he has a chance of more efficient management. There are many points which the inquiries have left untouched as yet, the most important probably being the question of the effects of different manures in varying quantities (the work has been carried out on unmanured pasture): this subject, and others, will, no doubt, be dealt with in due course. The results to date, however, mark a very great advance: we see the great desirability of getting pastures well grazed down at short intervals (three weeks to a month is probably the best), and that the food it provides *in this state* is a protein concentrate, and should be considered in that light if any supplementary feeding stuff is given. This means that, for feeding with closely grazed pasture, the cheaper starchy concentrates like the cereals are more suitable than the more expensive cakes with high protein content.

One other point of some considerable importance might be mentioned, and that is that the nutritive value of young herbage is only very slightly dependent on the species of the grasses providing it—all common species appear to yield valuable food rich in protein in the early stages of growth, and it is only when they approach maturity that wide differences develop between them: this indicates that close grazing is even more important on poor pastures than on good ones.

Under the system of pasture management which has been generally followed in the past, it will be realized that there will be considerable variations in the value of the herbage as consumed, throughout the grazing season, for its state of maturity has been allowed to vary a lot. That this is the case can be seen from what it has produced during different months : this is difficult to measure in the growing or fattening animal (for the errors of weighing animals are large compared with the increases made over short periods) but a measure of considerable accuracy can be obtained in the case of the milking cow. The best measure of the value of the food, for comparative purposes, is undoubtedly the rate at which the yield falls off, for the actual yield is largely determined by the conditions during the earlier stages of the lactation. The writer has studied this question at some length in about 4,000 lactation records of Norfolk cows, and found the average drop in yield, per week, to be as follows :—

April	..	..	0.45 lb.	August	..	..	4.77 lb.
May	..	..	1.23 „	September	..	..	6.12 „
June	..	..	7.86 „	October	..	..	5.17 „
July	..	..	6.38 „				

whilst it varied between 2.7 lb. and 3.7 lb. for the other months of the year. This is in complete agreement with the statement that has been made by Mr. Boutflour to the effect that, speaking generally, the summer management of our dairy herds is markedly inferior to their winter management. It will probably be agreed that the above figures might quite well be taken as definite measures of the state of maturity of average pastures throughout the season. In April, the grass is in a very young and nutritious state, so that cows in milk do not continue their normal falling off of yield with progress of the lactation, but remain practically constant, whilst in May the majority of the grasses are still young, and we see that the drop in yield is well below the average (about one-third of it). In June the story is very different : the mean rate of fall is nearly 8 lb. a week (just twice the average for the whole year), and there can be little doubt that this is caused by the fact that during May the grass has “got away” from the herd, and is now approaching a mature form. July is, normally, the wettest month of the year, and thus considerable growth is made (*i.e.* there is a greater proportion of young grass eaten) and this is shown in a reduced fall in yield, although the full effects are not seen until the next month,

DESCRIPTION	Price per qr.		Price per ton		Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.				£ s.	s. d.			d.	%
Wheat, British.. ..	—	—	9 17	0 13	9 4	72	2 7	1-38		9-6	
Barley, British feeding ..	—	—	9 15	0 10	9 5	71	2 7	1-38		6-2	
" Canadian No. 3 Western	32 6	400	9 2	0 10	8 12	71	2 5	1-29		6-2	
" " No. 4	31 3	"	8 15	0 10	8 5	71	2 4	1-25		6-2	
" " feed	29 9	"	8 7	0 10	7 17	71	2 3	1-20		6-2	
" American	30 0	"	8 8	0 10	7 18	71	2 3	1-20		6-2	
" Persian	30 9	"	8 12	0 10	8 2	71	2 3	1-20		6-2	
Oats, English, white	—	—	10 0	0 11	9 9	60	3 2	1-70		7-6	
" " black and grey ..	—	—	10 0	0 11	9 9	60	3 2	1-70		7-6	
" Canadian feed	21 0	320	7 7	0 11	6 16	60	2 3	1-20		7-6	
" Argentine	24 3	"	8 10	0 11	7 19	60	2 8	1-43		7-6	
" Chilean	24 6	"	8 12	0 11	8 1	60	2 8	1-43		7-6	
" German	27 3	"	9 10	0 11	8 19	60	3 0	1-61		7-6	
Maize, American	38 6	480	9 0	0 10	8 10	81	2 1	1-12		6-8	
" Argentine	37 9	"	8 17	0 10	8 7	81	2 1	1-12		6-8	
Peas, Japanese	—	—	17 10	1 2	16 8	69	4 9	2-54		18	
Dari	—	—	10 5	0 12	9 13	74	2 7	1-38		7-2	
Millers' offals—											
Bran, British	—	—	6 0	1 3	4 17	42	2 4	1-25		10	
" broad	—	—	6 12	1 3	5 9	42	2 7	1-38		10	
Middlings, fine, imported ..	—	—	7 10	0 18	6 12	69	1 11	1-03		12	
" coarse, British	—	—	6 12	0 18	5 14	53	2 0	1-07		11	
Pollards, imported	—	—	6 10	1 3	5 7	60	1 9	0-94		11	
Meal, barley	—	—	9 15	0 10	9 5	71	2 7	1-38		6-2	
" maize	—	—	10 0	0 10	9 10	81	2 4	1-25		6-8	
" " South African ..	—	—	9 0	0 10	8 10	81	2 1	1-12		6-8	
" " germ	—	—	9 10	0 16	8 14	81	2 2	1-16		10	
" locust bean	—	—	9 5	0 8	8 17	71	2 6	1-34		3-6	
" bean	—	—	12 15	1 5	11 10	66	3 6	1-87		20	
" fish	—	—	19 0	3 9	15 11	53	5 10	3-12		48	
Maize, cooked flaked	—	—	10 17	0 10	10 7	85	2 5	1-29		8-6	
" gluten feed	—	—	9 10	1 0	8 10	76	2 3	1-20		19	
Linseed cake, English, 12% oil	—	—	13 5	1 10	11 15	74	3 2	1-70		25	
" " " 9%	—	—	12 15	1 10	11 5	74	3 0	1-61		25	
" " " 8%	—	—	12 7	1 10	10 17	74	2 11	1-56		25	
Soya bean	—	—	11 7	2 3	9 4	69	2 8	1-43		36	
Cottonseed cake, English	—	—	7 5	9	5 16	42	2 9	1-47		17	
" " Egyptian, 4% ..	—	—	6 17	1 9	5 8	42	2 7	1-38		17	
Coconut cake, 6% oil	—	—	10 7	1 5	9 2	79	2 4	1-25		16	
Ground-nut cake, 6-7% oil ..	—	—	9 5	1 8	7 17	57	2 9	1-47		27	
Decorticated ground-nut cake,	—	—	11 17	2 3	9 14	73	2 8	1-43		41	
" 6-7% oil	—	—	11 17	2 3	9 14	73	2 8	1-43		41	
Palm kernel cake, 4-5% ..	—	—	9 5	0 18	8 7	75	2 3	1-20		17	
" " meal, 4%	—	—	9 15	0 18	8 17	75	2 4	1-25		17	
" " meal 1-2%	—	—	8 15	0 19	7 16	71	2 2	1-16		17	
Feeding treacle	—	—	6 5	0 9	5 16	51	2 3	1-20		2-7	
Brewers' grains, dried ale ..	—	—	8 0	0 19	7 1	49	2 11	1-56		13	
" " " porter	—	—	7 15	0 19	6 16	49	2 9	1-47		13	
Malt culms	—	—	6 10	1 8	5 2	43	2 4	1-25		16	

† At Hull.

‡ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of June and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22-4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1-43d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 6s. 6d.; P, 0s. 8s. 9d.; K, 0s. 3s. 5d.

August. In September, growth slows up again and consequently the cows are eating more mature herbage, which has a further detrimental effect on their yields.

If any evidence of the practical importance of Dr. Woodman's results were needed, these figures would supply it: there can be no doubt that a much greater efficiency would be obtained if grasses were managed so that cows were always eating *short* herbage right through the summer. It is not desired to minimize the difficulties of estimating the stocking required to achieve this desirable state of affairs, with an unknown rainfall to be considered, but even if it meant the use of the mower now and then, it would probably be well worth while,

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	8 13
Maize	81	6.8	8 18
Decorticated ground nut cake	73	41.0	11 17
„ cotton cake	71	34.0	11 10

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2.25 shillings, and per unit protein equivalent, 2.17 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1928, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	9 3
Oats	60	7.6	7 11
Barley	71	6.2	8 13
Potatoes	18	0.6	2 2
Swedes	7	0.7	0 17
Mangolds	7	0.4	0 17
Beans	66	20.0	9 12
Good meadow hay	37	4.6	4 13
Good oat straw	20	0.9	2 7
Good clover hay	38	7.0	5 1
Vetch and Oat silage	13	1.6	1 13
Barley straw	23	0.7	2 13
Wheat straw	13	0.1	1 9
Bean straw	23	1.7	2 15

for the increase in the yield of milk over the year would be very large. Nor need the benefits of close grazing be kept to milking cows, for there is every reason to believe that the gains made by growing and fattening animals are subject to the same effects : Mr. Hammond found that a bunch of lambs turned on to vetches gained 5 lb. a week for the first fortnight, but only 2 lb. a week after six weeks, when the crop was approaching maturity. Green foods, therefore, should always be fed in a young state, for then they will play the part of concentrates, and so save a large amount of expense on bought food-stuffs. The total bulk of produce per acre will probably be lowered slightly, but this is much more than compensated for in its increased nutritive value.

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MISCELLANEOUS NOTES

A NOTE in the August, 1928, issue of this JOURNAL recorded the publication of a volume containing abstracts of papers on agricultural research work in the

**Abstracts of
Papers on
Agricultural
Research
Vol. II.**

United Kingdom which had appeared in print during the academic year, October, 1926, to September, 1927. This volume, prepared for the Imperial Agricultural Research Conference (held in October, 1927), has now been followed by a second,

which continues the record of published papers on British agricultural research for the succeeding year, October, 1927, to September, 1928. Like its predecessor, this second volume summarizes the papers under 14 headings, such as "soils," "entomology," "animal diseases," "dairying," etc., but the papers abstracted have been limited to those dealing with results or methods of work. The abstracts have been made by the investigators themselves.

The primary object of these publications is to enable agricultural research and advisory workers in other parts of the Empire to keep abreast of the work being done in the mother country ; but these summaries of work should prove of great interest and value to all concerned with agriculture and allied industries at home or abroad. They contain in a form easy for reference a vast amount of information that could otherwise be obtained only at the expenditure of much time, trouble and money.

It may be mentioned that copies of the first volume can still be purchased, and that both are obtainable, price, post free, 1s. each, from the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

THE National Institute of Agricultural Botany wishes to extend an invitation to parties of farmers, potato growers and merchants, and agricultural advisory and administrative officers to visit the **Ormskirk Potato Trials, 1929** Potato Testing Station, Ormskirk, singly or in parties on August 8, 1929, or if this date is inconvenient on August 9 or 10.

Besides the usual trials of new varieties of potatoes for immunity from wart disease the Institute is continuing for the Ministry of Agriculture and Fisheries investigations into the relative resistance of a number of varieties to leaf-roll, and the possibility of growing in England seed potatoes free from virus diseases. These trials will be open to the inspection of visitors. In addition visitors will be able to see the Lord Derby Gold Medal Trials—of which there are three separate trials this year—and Yield and Maturity Trials of the leading early and main crop potatoes. There is also a large number of demonstration plots of British and foreign varieties of potatoes, including those certified as immune in 1927 and 1928, and an interesting series of plots of some common potato synonyms.

Secretaries of branches of the National Farmers' Union and others wishing to organize parties to see the trials should write to the Superintendent of Potato Trials, Potato Testing Station, Lathom, Ormskirk, Lancs., suggesting alternative dates. Individual visitors will be equally welcome, but they too should inform the Superintendent of the date of their visit not less than a week in advance. Ormskirk is conveniently reached by a frequent service of local trains from either Liverpool or Preston.

* * * * *

THE Sixth Annual *Poultry Conference* of the Midland Agricultural and Dairy College, Sutton Bonington, Loughborough, will be held on Tuesday, September 24, 1929, commencing at 10.45 a.m. Mr. P. A. Francis, the Poultry Commissioner of the Ministry of Agriculture and Fisheries, will preside, and discussions will be opened by Mr. Marcus Slade on "Sex-Linked Cross-Breds and their Place in the Industry"; by Major C. J. Saunders, M.R.C.V.S., on "Poultry Diseases" and by Dr. J. E. Helm on "Some Breeding Problems."

The Pig Conference will be held on the following day,

September 25, when Mr. Leopold Paget will preside. Dr. Charles Crowther, Principal of the Harper Adams Agricultural College, will open a discussion on "Pig Feeding," and there will be another discussion on "Pig Breeding." In connexion with this Conference, the Ministry will have a Marketing Demonstration Tent.

These Conferences, each of which lasts a day, are arranged to give residents in the locality an opportunity of hearing short papers by experts upon these two branches of agricultural work, and of joining in the discussions that follow. Particulars of the arrangements, accommodation for visitors, meals, etc., can be obtained on application to Dr. Thos. Milburn, the Principal of the Midland College, as above.

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THE June index number of prices of agricultural produce was 40 per cent. above the level of 1911-13, or 4 points lower than in the previous month and 13 points

The Agricultural Index Number lower than in June last year. There was a fall in the prices during the month under review of practically all the commodities and classes of livestock considered for index number purposes, but the most marked declines were shown in the case of fat pigs and potatoes.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1924 :—

Percentage increase compared with the
average of the corresponding month in
1911-13

Month	1924	1925	1926	1927	1928	1929
January	60	71	58	49	45	45
February	61	69	53	45	43	44
March	57	66	49	43	45	43
April	53	59	52	43	51	46
May	57	57	50	42	54	44
June	56	53	48	41	53	40
July	53	49	48	42	45	—
August	57	54	40	42	44	—
September	61	55	55	43	44	—
October	66	53	48	40	39	—
November	66	54	48	37	41	—
December	65	54	46	38	40	—

Grain.—Wheat averaged 9s. 7d. per cwt. and oats 9s. 5d., both cereals being 4d. per cwt. cheaper on the month, while the relative index numbers fell by 4 and 5 points respectively to 21 and 26 per cent. above pre-war. A year ago wheat was 38 per cent. and oats were 69 per cent. dearer than in 1911-13.

Barley also was cheaper in June at an average of 9s. 10d. per cwt. and 33 per cent. above the base years, as against an average of 10s. 10d. per cwt. and 46 per cent. above pre-war last June.

Live Stock.—Fat cattle were very slightly cheaper than in May, and the index number declined from 32 to 31 per cent. above the base years, and fat sheep were about $\frac{1}{4}$ d. per lb. cheaper, although in this instance the fall was comparatively less pronounced than in June, 1911–13, and the relative index number showed a rise of 2 points. The index for store sheep was affected similarly, and a rise of 14 points was recorded, while the fall in values for dairy cows by about 13s. per head and store cattle about 6s. was sufficient to depress the index numbers by 1 and 2 points respectively. Store pigs were about 2s. per head cheaper than in May, and prices for fat pigs, especially baconers, were appreciably lower, the index figures being reduced by 11 and 13 points to 70 per cent. above pre-war for baconers and 65 per cent. for porkers.

Dairy and Poultry Produce.—Butter was about $1\frac{1}{4}$ d. per lb. cheaper at an average of 1s. $4\frac{3}{4}$ d., and cheese declined about 15s. per cwt., the price being affected largely by the marketing of the new season's make. There was no alteration in milk contract prices, and the index remained unaltered on the month at 57 per cent. above pre-war. Poultry sold at lower values, the index falling 2 points to 63 per cent. over the base years, but while there was practically no change in the average price for eggs during June this year a rise occurred in June, 1911–13, and on this account the index number shows a fall of 10 points.

Other Commodities.—Hay prices made a further advance of from 3s. to 4s. per ton in June, and the index number rose by 5 points to 27 per cent. above the pre-war level. Potatoes, however, were about 25s. per ton cheaper, the average level of prices falling by 31 points to the very low figure of 34 per cent. below pre-war, which is the lowest point reached since the corresponding season of 1923. Wool prices at Bradford fell during June in consequence of the lower levels recorded at the country wool sales. Of the fruits marketed during the month under review, cherries averaged about double the pre-war price, gooseberries about 40 per cent. and strawberries about 55 per cent. more than in 1911–13. Among the vegetables, cabbages were about 70 per cent. and cauliflowers about 115 per cent. dearer than in the base years.

Index numbers of different commodities during recent months and in June, 1927 and 1928, are shown below :—

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1927	1928	1929			
	June	June	Mar.	April	May	June
Wheat	60	38	30	30	25	21
Barley	54	46	28	32	34	33
Oats	33	69	36	36	31	26
Fat cattle	25	47	33	31	32	31
Fat sheep	48	83	52	53	57	59
Bacon pigs	54	43	58	73	81	70
Pork pigs	60	38	66	74	78	65
Dairy cows	21	32	30	29	32	30
Store cattle	21	26	22	18	23	22
Store sheep	53	55	56	54	51	65
Store pigs	90	22	57	71	81	77
Eggs	30	38	93	45	50	40
Poultry	53	52	40	38	65	63
Milk	53	53	60	77	57	57
Butter	41	54	54	51	50	46
Cheese	54	91	74	76	81	67
Potatoes	61	125	40	15	—3*	—34*
Hay	3	13	7	10	22	27
Wool	33	75	60	59	59	50

* Decrease

* * * * *

DETAILS concerning the operation of the scheme during its fifth season show steady growth of interest in this effort

to improve the milch goats of small

Stud Goat holders, cottagers and persons of similar

Scheme, 1928-9 positions. The progress which has been

achieved since the inauguration of the

scheme is indicated by the following table :—

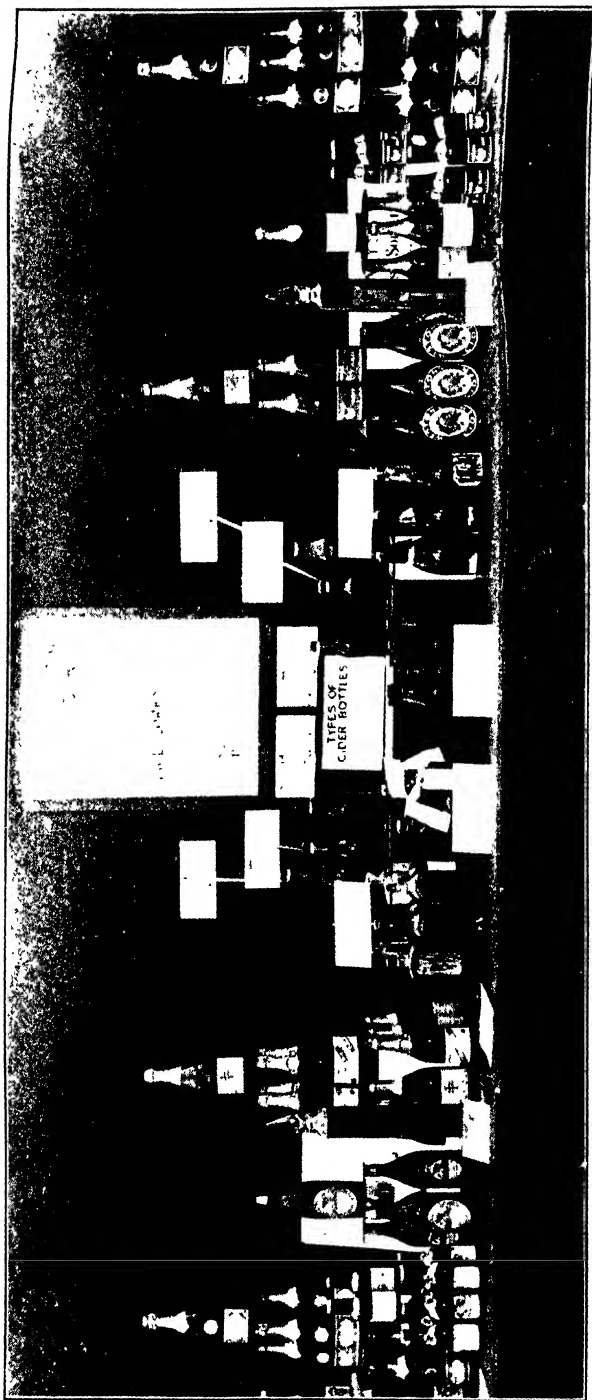
Season	Counties	Goats entered	Goats registered	Services given	Services allowed for premium
1924-5 ..	27	106	73	882	841
1925-6 ..	28	108	89	1,115	1,077
1926-7 ..	32	115	104	1,603	1,496
1927-8 ..	31	128	113	1,609	1,491
1928-9 ..	39	130	108	1,844	1,719

The stud animals in 1928-9 were stationed at 104 centres, an increase of 31 over the 1924 figure, Cardiganshire, Merionethshire, Northamptonshire and Nottinghamshire being represented for the first time. Of the total number of goats entered only



Fruit Marketing Demonstration at the Three Counties Show, Gloucester

MARKETING DEMONSTRATIONS AT AGRICULTURAL SHOWS.



Cider Marketing Exhibit at the Three Counties Show, Gloucester.

MARKETING DEMONSTRATIONS AT AGRICULTURAL SHOWS.

16 failed to qualify for premium. Eight of the 10 goats standing in County Durham qualified for full premium.

In recording continued progress during another season, due acknowledgment must be given to the British Goat Society, which is responsible for the inspection of the goats and the general management of the scheme.

* * * * *

MARKETING demonstrations were given at five shows during July, including the Show of the Royal Agricultural Society of England at Harrogate (July 9-13), where the sections covering pigs, poultry, cattle, cereals, fruit, potatoes and the National Mark were staged.

**Marketing
Demonstrations
at Agricultural
Shows**

At the Three Counties Agricultural Show held at Gloucester, in June, the Fruit Marketing demonstration attracted a large audience throughout the whole of the three days. The "Ideal" mechanical grader for apples and pears was demonstrated at this show for the first time (Fig. 1).

Another photograph (Fig. 2) shows the cider exhibit, illustrating incorrect and correct methods of bottling and labelling, supported by a selection of commercial samples obtained from farmers who market their cider on modern lines.

The Ministry's summer programme concludes with the Royal Welsh Show at Cardiff (August 7-9), where the same series of demonstrations will be staged as at the Royal Show.

* * * * *

THE summer meetings of Advisory Entomologists and Mycologists were held at the School of Agriculture, Cambridge, on June 20 and 21, 1929. *Entomologists*.—

**Conferences of
Advisory
Entomologists
and Mycologists** Progress reports on the co-operative experiments in regard to a potato trouble generally, although possibly erroneously, attributed to Eelworm, and also in regard to "Root Flies" were considered, the

Advisory Mycologists attending for a joint discussion of the position regarding the potato disease. Mr. F. R. Petherbridge gave an account of the history and development of the work in the Cambridge province, discussing the main problems in the light of his experience in the province.

Mycologists.—In addition to potato disease (dealt with jointly as indicated above) the principal subjects discussed by the Mycologists were phyto-pathological problems and

investigations in East Anglia; the *Fusarium* diseases of cereals; and swede-seedling infection with *Phoma Lingam*.

On the completion of the indoor proceedings (which included inspection of specimens in the laboratories) the meeting proceeded to the University Farm for inspection of field work (transmission of virus diseases, etc.), the Conferences afterwards merging with the Annual Field Meeting of the Association of Economic Biologists.

* * * * *

NEW regulations in respect of apples and pears, in substitution for and revoking the regulations of last year, were made on June 19, 1929.

**Agricultural
Produce
(Grading and
Marking) Act,
Apples and
Pears**

Under the new regulations modifications are made in certain definitions of the size and colour of fruit packed under the National Mark Scheme.

Copies of the regulations are obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, or through any bookseller, price 1d.

Packers desirous of being authorized to apply the National Mark to apples and pears are urged to apply to the Local Branch of the National Farmers' Union for their county or to the Secretary, National Farmers' Union, 45, Bedford Square, London, W.C. 1, *as soon as possible*, in order that the necessary formalities may be completed before the commencement of the packing season.

* * * * *

THE Council of the Royal Agricultural Society of England announce the offer of a silver medal for agricultural research.

**The R.A.S.E.
Agricultural
Research
Medal**

The medal, to which will be added money or books to the value of £10, will be awarded for a monograph or essay giving evidence of original research on any agricultural subject, or on any of the cognate agricultural sciences, or on agricultural economics. It must be attested by the candidate as his own genuine work. Essays already published will not be eligible for the medal. Candidates must be resident in Great Britain or Ireland and must not be more than thirty years of age on September 29 this year. The award will be decided by referees appointed by the Council of the Society. Only type-written or printed monographs and essays will be considered, and these must be forwarded to reach the Secretary of the

Society, 16, Bedford Square, London, W.C. 1, on or before October 31, 1929. If in the opinion of the referees no monograph or essay is found to attain a sufficient standard of excellence, the Council will be at liberty to reserve the medal for award as an additional medal in a subsequent year. The monograph or essay of a successful candidate, if deemed suitable by the Council, will be published in the JOURNAL of the Society.

* * * * *

THE Fream Memorial Prize this year has been awarded to Mr. Eric Leonard Jones, a student of the University College of Wales, Aberystwyth. The recipient

The Fream Memorial Prize was a Herefordshire County Council scholarship holder, and his success has given much satisfaction locally. This prize, provided from a fund entrusted to the Ministry as a memorial to the late Dr. Fream, is awarded annually by the Department to the candidate who obtains the highest marks in the examination for the National Diploma in Agriculture. The value of the prize is approximately £7, and is devoted to the purchase of books selected by the recipient as best calculated to assist him in pursuing his agricultural studies.

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DURING July, milk and dairy products have formed the Home Produce display in the Empire Marketing Board Pavilion at the North-East Coast Exhibition, Newcastle-upon-Tyne. A feature of this display was the selling of samples of many types of cheese, both hard and crustless. This aroused great interest among visitors, many of whom appeared to have no previous knowledge of the cheeses shown and commented on their flavour and quality. During a fortnight of this period, a popular demonstration of cheese and butter-making was organized by Armstrong College.

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Tanganyika Agricultural and Industrial Exhibition, 1929.—This Exhibition, of which a preliminary announcement was given in the December, 1928, issue of this JOURNAL, will be held at Dar-es-Salaam from September 2 to 6. Colonel W. H. Franklin, C.B.E., D.S.O., H.M. Trade Commissioner in East Africa, is making arrangements to attend in order to assist local firms and individuals who may be desirous of purchasing British agricultural machinery, plant and materials, and is taking with him, from his headquarters at Nairobi, all suitable catalogues in his possession. Agricultural machinery seems likely to be most in request.

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on Tuesday, July 16, 1929, at 7 Whitehall Place, London S.W. 1, the Rt. Hon. the Viscount Ullswater, G.C.B., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying these decisions into effect.

Buckinghamshire.—An Order cancelling as from July 21 the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers, and fixing minimum and overtime rates of wages for male and female workers as from July 22. The minimum rate in the case of male workers of 21 years of age and over is 31s. per week of 50 hours in summer and 48 hours in winter with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays and public holidays. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour with overtime at 7½d. per hour on weekdays and 9d. per hour on Sundays and public holidays. These rates will continue in operation until further notice.

Cambridgeshire and Isle of Ely.—An Order fixing special minimum rates of wages for the employment of male and female workers on the corn harvest, the rate in the case of male workers of 21 years of age and over being £11 for a period of 4 weeks of 64 hours per week (excluding Sunday) with payment for Sunday work and for employment in excess of 64 hours per week at 11d. per hour. The special minimum rate for female workers of 18 years of age and over is 8d. per hour.

Essex.—An Order fixing special minimum rates of wages for the employment of male and female workers during the corn harvest, the rates for male workers of 21 years of age and over being (a) on farms of over 60 acres of corn £5 5s. 0d for the harvest (or where the worker has worked a part only of the harvest period a due proportion of such sum) in addition to the ordinary minimum weekly wages and in lieu of overtime rates. The hours in respect of which the harvest wage is payable are not to exceed 11 per day. (b) On farms of 60 acres of corn and under 10½d. per hour for all employment on harvest work. The special minimum rate for female workers of 21 years of age and over on all farms is 7½d. per hour for all employment on harvest work.

Hertfordshire.—An Order fixing special minimum rates of wages for the employment of male and female workers on the corn harvest, the rate in the case of male workers of 21 years of age and over being 10½d. per hour, and in the case of female workers of the same age 7½d. per hour.

Suffolk.—(a) An Order fixing special minimum rates of wages for employment of male workers during the corn harvest, the rates for such workers of 21 years of age and over being (1) in the case of farms of at least 60 acres of corn £5 for the harvest in addition to the minimum weekly wage and in lieu of overtime rates, the hours in respect of which this rate is payable being 12 on any weekday whilst the crops are being carted and 11 whilst other harvest work is in progress, but so that the hours in any one week shall not exceed 70. Where a worker is employed for a part only of the harvest the special minimum rate is 10d. per hour for all employment on harvest work. (2) In the case of farms of less than 60 acres of corn 10d. per hour for all employment on harvest work.

(b) An Order cancelling as from December 21, 1929, the existing minimum and overtime rates of wages for male workers and fixing

fresh rates in substitution therefor as from December 22. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 39½ hours during Christmas week, 48 hours during any other week in winter and 50 hours per week in summer, with in addition in the case of horsemen, cowmen or shepherds an inclusive weekly sum of 6s. in respect of employment up to 10 hours per week on work in connection with the immediate care of animals. The overtime rate in the case of male workers of 21 years of age and over is 9d. per hour.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Special Minimum Rates of Wages for the Corn Harvest.—Special rates of wages for employment on this year's corn harvest have been fixed by 11 of the Agricultural Wages Committees, the rates in each case being similar to those fixed last year.

In certain areas, the special rates take the form of increased rates for overtime employment on harvest work, the rate for male workers of 21 years of age and over being 10d. per hour in *Devonshire, Dorset and Somerset*, and 9d. per hour in *Hampshire* and the *Isle of Wight* and *Wiltshire*. In the *East Riding of Yorkshire* the special overtime rates are : for male workers of 21 years of age and over who are not boarded and lodged by their employer, 1s. 3d. per hour ; and for workers who are boarded and lodged by their employer : foremen, beastmen, shepherds and waggoners, 1s. per hour ; third and fourth lads, 9d. per hour ; and other beginners 7d. per hour : while in the case of female workers of 16 years of age and over the special overtime rate is 11d. per hour.

In *Cambridgeshire* and the *Isle of Ely*, special minimum rates have been fixed, the rate in the case of male workers of 21 years of age and over being £11 for a period of four weeks of 64 hours per week ; employment on Sundays or in excess of 64 hours per week is to be paid for at the rate of 11d. per hour ; the special minimum rate for female workers of 18 years of age and over is 8d. per hour.

In *Essex*, special minimum rates of wages have been fixed, the rate in the case of male workers of 21 years of age and over on farms of over 60 acres of corn being a sum of £5 5s. for the harvest period in addition to the ordinary weekly minimum rates and in lieu of overtime rates. On farms of 60 acres of corn and under, the special minimum rate for the harvest period is 10½d. per hour for male workers of 21 years of age and over. In the case of female workers of 21 years of age and over on all farms the special minimum rate is 7½d. per hour.

In *Hertfordshire*, special hourly minimum rates of wages have been fixed, the rate in the case of male workers of 21 years of age and over being 10½d. per hour and in the case of female workers of the same age 7½d. per hour.

Special minimum and overtime rates of wages have been fixed in *Norfolk*, those in the case of male workers of 21 years of age and over being £11 for the full month of 24 consecutive working days (excluding Sundays) or for the harvest period as the case may be. Where a worker does not work the full harvest period, special differential rates are payable for overtime employment on harvest work, the rate in the case of male workers of 21 years of age and over being 9½d. per hour.

In *Suffolk*, special minimum rates of wages have been fixed, the rate in the case of male workers of 21 years of age and over on farms of at least 60 acres of corn being £5, payable in addition to the ordinary minimum wage and in lieu of overtime payment, the hours of work being not more than 12 per day while the crops are being carted, and

11 per day while other harvest work is in progress, but so that the total hours shall not exceed 70 in any one week. On farms of less than 60 acres of corn, the special minimum rate for male workers of 21 years of age and over is 10d. per hour.

Except in the cases of Cambridgeshire and Isle of Ely, Essex, Hertfordshire and the East Riding of Yorkshire, the rates which have been fixed apply to male workers only. In all cases lesser rates are fixed for younger workers.

Copies of the Orders in full may be obtained, free of charge, on application to the Secretary, Agricultural Wages Board, 7 Whitehall Place, London, S.W. 1.

In areas where the Agricultural Wages Committees have not fixed any special rates for the Corn Harvest, employment on such work must, of course, be paid for at not less than the ordinary minimum and overtime rates.

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Enforcement of Minimum Rates of Wages.—During the month ending July 15, legal proceedings were instituted against six employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages			No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	d.	
Beds ..	Bedford ..	1	0	0	—			7	8	6	1
Lancs ..	Leyland ..	1	10	0	—			4	4	0	2
„ ..	Blackburn.	2	0	0	0	5	0	12	19	6	1
Monmouth	Monmouth	1	0	0	4	1	0	14	0	0	1
Yorks, N.R.	Wath ..	10	0	0	—			17	19	9	4
		£15	10	0	£4	6	0	£56	11	9	9

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Foot-and-Mouth Disease.—No further outbreaks having occurred in the Hants Infected Area—referred to in the July issue of this JOURNAL—the restrictions in force in that area were withdrawn on July 7, and the position as this issue of the JOURNAL goes to Press is that, as from the latter date, no general movement restrictions remain in force in connexion with Foot-and-Mouth Disease in any part of Great Britain.

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Leaflets issued by the Ministry.—Since the date of the list given in the March, 1929, number of this JOURNAL, p. 1194, the following Leaflets have been issued :—

New :—

No. 27.—Agricultural Credits Act, 1928 (Part II).

No. 85.—Notes on Circumstances affecting Quality of Milk.

Revised :—

No. 83.—Preservation of Eggs.

No. 126.—The Sheep Maggot Fly.

No. 319.—Apple Capsids.

No. 335.—Potash Fertilizers.

No. 344.—Compound Manures.

No. 394.—Phosphatic Fertilizers.

No. 370.—Nitrogenous Manures.

No. 400.—List of Publications.

Rewritten :—

- No. 41.—Fruit Tree Red Spiders.
 No. 262.—Tomato Leaf-mould Disease.
 No. 264.—Onion Growing.

Amended :—

- No. 80.—The Use of Artificial Manures.
 No. 276.—Commercial Mushroom Cultivation.

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APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

- Buckinghamshire** : Mr. A. E. B. Langman, C.D.H., has been appointed Horticultural Superintendent, *vice* Mr. P. Mann, F.R.H.S.
Cheshire : Mr. C. Savidge has been appointed Assistant Lecturer in Horticulture, *vice* Mr. A. E. B. Langman, C.D.H.
Northamptonshire : Mr. G. Wells, N.D.A., N.D.D., has been appointed Assistant Instructor in Dairying and Poultry-Keeping, *vice* Mr. R. A. Jeffery, N.D.A., N.D.D.
Yorkshire (University of Leeds, Agricultural Department) : Miss M. Evelyn, N.D.D., has been appointed Assistant Instructress in Dairying, *vice* Miss B. C. S. Prowse, N.D.D., B.D.F.D.
 Miss E. G. Stoward, N.D.P., has been appointed Assistant Lecturer in Poultry Husbandry, *vice* Mr. C. W. Goode, N.D.A., N.D.D.

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NOTICES OF BOOKS

Essex County Farmers' Union Year Book, 1929.—Edited and compiled by John B. Gill. Pp. 400. (Chelmsford : Offices of the Union, The Corn Exchange. Price 2s. 6d. net.)

This is another of the thick and meaty books to which Mr. Gill has accustomed his public, and in which the essential particulars of domestic affairs are supplemented by a long list of articles—"Social, Economic, Educational, Political"—by acknowledged authorities of the agricultural world. The "Special Articles" section, indeed, fills nearly two-thirds of the book, and space here does not permit mention in detail of either authors or the varied subjects with which they deal. One may, however, cite, as evidence of the standard, the contributions of Sir Rowland Biffen on Rust—a curse, on Biblical authority, of Israelite days ; Sir John Russell on the Manuring of Sugar Beet ; Dr. Stenhouse Williams and Mr. Hiscox on the Value of Milk ; and Professor T. B. Wood on Grassland Husbandry in Switzerland—"grass" being a curious mixture of clovers, dandelion and chicory, cultivated, however, on the accepted "newly-mown" method of which Cambridge has long preached the virtues. Mr. Gill and his 39 special contributors have produced a volume of great merit and usefulness, which claims a rather more permanent place on the bookshelf than the term "Year Book" usually connotes.

The Welsh Journal of Agriculture.—Vol. V, January, 1929. Pp. 260. (Cardiff : Published for the Welsh Agricultural Conference by the University of Wales Press Board. Price, 2s. 6d. paper ; 4s. cloth.)

Cattle questions are rather a prominent feature in the contents of this issue of the Welsh Journal, Messrs. A. W. Ashby and Thomas Lewis leading off with a paper on "The Cattle Population of Wales and the Cattle Supply." The same writers follow this up with a second on "Beef Production," dealing with seasonal variations in the supplies and prices of fat cattle, while Mr. Lewis contributes a third on "The Marketing of Cattle in Wales." Mr. E. J. Roberts considers

"Wastage in Dairy Herds" mainly in its relation to calving, and from the records of the herds under his observation concludes that summer calvers are more subject to wastage than spring calvers, that the wastage point becomes pronounced after the second calving, and that 26 per cent. of the cows in the herds in question have to be renewed annually. Of papers on other subjects may be noted those by Dr. Alun Roberts and Mr. W. A. Jones, also Mr. William Davies, on grassland matters; a lengthy paper by Dr. Whitehead and Mr. W. A. Jones on dry-rot of swedes, and a discussion of effective measures for controlling the attacks of weevils on red clover by Mr. J. R. W. Jenkins.

Agricultural Experiments in Cornwall.—By W. Hawk, C.B.E. Pp. v+251. (1929. Copies obtainable from The Agricultural Organizer, County Hall, Truro. Price 2/6, Postage 6d. extra.)

The most famous of long-continued agricultural experiments are those of the Rothamsted Experimental Station. Other series, which have been carried out for shorter periods, are those at Cockle Park, Northumberland and at Saxmundham, Suffolk, but the work which has been done in Cornwall, well known as it may be in that county, has not become the common possession of agriculturists throughout the country in quite the same way. The present publication is therefore welcome as placing the experience gained in the course of thirty years' work before a wider public than that to which it was previously accessible.

It is true that the county is exceptional in its climate, its configuration and its soils as compared with the rest of England. In an "historical sketch" Mr. Hawk refers to Dr. Borlase, whose book on Cornwall is always quoted by writers on eighteenth century agriculture, as saying that both mining and agriculture should be encouraged in the county, "so that the former may promote plenty of money and the latter food and raiment, and both the happiness of that spot where they meet." The farmers of the county were, however, always alive to the possibilities of their situation, and, in some respects, were in advance of their contemporaries in other districts. It may be that the peculiarities of their environment led them to adopt expedients not in vogue elsewhere. In 1724, Herman Moll ("A New Description of England and Wales") says the county was "more inclined to Barrenness than Fertility; but the Parts to the Seaward, by reason of the industrious Husbandman's manuring the Ground with Sand and Oreweed taken from the Seashore bears good Corn, and feeds store of Sheep and other Cattle; and the inland Part, except the Inclosures about some Towns and Villages, lies pretty waste and open, bearing Heath and spiny Grass, and serves chiefly for Summer Cattle . . . !"

In spite, therefore, of the importance of the mining, quarrying and pilchard industries, agriculture formed the occupation of a large proportion of the population even in the eighteenth century. Moreover, stale pilchards were often used for manure then, and in some seasons of good harvest the county was able to export supplies of bread corn to other parts, although in poor seasons it was forced to import.

The trade in mineral products probably put the Cornwallishmen in touch with outside ideas, and rendered them more receptive to new systems than inhabitants of some of the more completely agricultural counties, and that receptivity, having been continued to the present time, has made possible the series of experiments described in Mr. Hawk's book. The good results can only be judged by an examination of the agriculture of the county, which can scarcely be dealt with here. It is, indeed, hardly possible to give an adequate idea of the scope of the work undertaken without quoting the contents list of the book; it must therefore suffice to say that practically every problem that can have confronted the farmers of the county has been attacked and observations made that are instructive and informative.

SELECTED CONTENTS OF PERIODICALS**Agriculture, General and Miscellaneous**

- Farming in Yorkshire. *G. C. A. Robertson.* (Jour. Roy. Agric. Soc. Eng., Vol. 89 (1928), pp. 50-66.) [63 (42).]
- Dales and Fell Farming. *W. Carter Platts.* (Jour. Roy. Agric. Soc. Eng., Vol. 89 (1928), pp. 77-86.) [63.192.]
- The Work Efficiency of Farm Organization in Wales, 1871-1921. *A. W. Ashby and J. L. Davies.* (Welsh Jour. Agric., v (1929), pp. 50-67.) [331 (429); 63.191.]
- Special Agricultural Industries of Canada. I. *E. H. Godfrey.* (Scottish Jour. Agric., xii, 2 (Apr., 1929), pp. 149-155.) [63 (71); 63.343; 63.71 (71); 63.41 (71).]
- Organization of Agricultural Research in Northern Ireland. *G. S. Robertson.* (Agric. Prog., vi (1929), pp. 87-94.) [37 (416).]
- Agricultural Administration in Ulster. *J. S. Gordon.* (Agric. Prog., vi (1929), pp. 37-41.) [35 (416); 63 (416).]
- Reclamation of Moss Land in Dumfriesshire. *J. Gillies.* (Scottish Jour. Agric., xii, 2 (Apr., 1929), pp. 126-139.) [63.12.]
- Land Drainage and Rights of Riparian Proprietors. *D. Meston.* (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. iii (1928-29), pp. 7-15.) [333.5; 63.14.]
- Pit Silage. *R. Mackenzie.* (Agric. Prog., vi (1929), pp. 47-53.) [63.19832.]
- Germicides and Antiseptics. *J. F. Malcolm.* (Scottish Jour. Agric., xii, 2 (April, 1929), pp. 174-185.) [614.4.]

Economics

- World Agriculture and International Price Stabilisation. *D. Ferguson and J. K. Montgomery.* (Int. Rev. Agric., Part II, Agric. Econ., xx, 1 (Jan., 1929), pp. 1-12.) [338.1; 338.5.]
- The Dependence of British Agriculture on International Factors. *Sir Daniel Hall.* (Jour. Roy. Inst. International Affairs, viii, 1 (Jan., 1929), pp. 21-40.) [338.1.]
- The International Situation in Agriculture and the World's Economic Conference, 1927. *R. R. Enfield.* (Jour. Roy. Inst. International Affairs, viii, 1 (Jan., 1929), pp. 41-47.) [338.1.]
- Some Aspects of the Experience of American Agricultural Producers in the Marketing of their Products. Substance of an address by *R. B. Forrester.* (Jour. Roy. Inst. International Affairs, viii, 3 (May, 1929), pp. 260-268.) [338.1 (73); 381.]
- Population and Rewards in Agriculture. *E. Whittaker.* (Scottish Jour. Agric. xii, 2 (April, 1929), pp. 190-195.) [325.3; 331.]

Soils and Fertilizers

- Field Work on the Soils of Kent. *B. S. Furneaux.* (Agric. Prog., vi (1929), pp. 70-77.) [63.111.]
- Soil Surveys. *T. Wallace.* (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. iii (1928-29), pp. 46-59.) [63.111.]
- The Determination of Organic Carbon in Soils. *G. W. Robinson, W. McLean and Rice Williams.* (Jour. Agric. Sci., xix, 2 (April, 1929), pp. 315-324.) [63.113.]
- Poor Heavy Land and its Problems. *A. W. Oldershaw.* (Agric. Prog., vi (1929), pp. 45-47.) [63.114; 63.192.]
- Rotation Experiments with Lime. (Jour. Irish Dept. Agric., xxviii (1929), 2, pp. 160-164.) [63.15; 63.191.]
- The Utilization of Local Supplies of Chalk and Limestone for Liming Land. *T. Wallace.* (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. III (1928-29), pp. 60-70.) [63.15.]

The Leaching out of Autumnal Dressings of Nitrogenous Fertilizers. *H. H. Nicholson* and *Barbara Pantin*. (Jour. Agric. Sci., xix, 2 (April, 1929), pp. 297-301.) [63.1671.]

The Production of Artificial Manure from Oats Straw under Control Conditions. *P. E. Brown* and *F. B. Smith*. (Jour. Amer. Soc. Agron., 21,3 (March, 1929), pp. 310-322.) [63.1621; 63.165.]

Some Observations on the Purchase and Use of Manures. (With special application to the County of Somerset.) *W. D. Hay*. (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. III (1928-29), pp. 38-46.) [63.162; 63.1626.]

Field Crops

Problems relating to the Development of Grassland. *A. E. V. Richardson*. (Jour. Coun. Sci. and Ind. Res. (Australia), 2, 1 (Feb., 1929), pp. 5-15.) [63.33.]

The New System of Grassland Manuring and Management. (Jour. Irish Dept. Agric., xxviii (1929), 2, pp. 168-172.) [63.33; 63.33-16.]

Methods of Pasture Analysis. *R. A. Roberts*. (Agric. Prog., vi (1929), pp. 68-70.) [63.33.]

Some Studies in Pasture Establishment. *R. A. Roberts* and *W. A. Jones*. (Welsh Jour. Agric., v (1929), pp. 117-126.) [63.33.]

Nationality and Strain Test of Grasses (with Observations on Pasture Analysis Methods). *R. A. Roberts* and *W. A. Jones*. (Welsh Jour. Agric., v (1929), pp. 126-133.) [63.33.]

Seeds Mixture Problems: Sowing and After-Management. *W. Davies*. (Welsh Jour. Agric., v 1929), pp. 133-137.) [63.33.]

The Warmbold System under Welsh Conditions. *J. J. Griffith* and *R. Phillips*. (Welsh Jour. Agric., v (1929), pp. 83-98.) [63.33; 63.33-16.]

Grassland Farming on the Fattening Pastures of Leicestershire. *T. Hacking*. (Agric. Prog., vi (1929), pp. 41-44.) [63 (42); 63.33; 63.6 (42).]

The Improvement of Herbage Plants. *R. G. Stapledon* and *T. J. Jenkin*. (Jour. Brit. Dairy Farmers' Assoc., xli (1929), pp. 9-24.) [63.33.]

The Principles of Compounding Mixtures of Grass and Clover Seeds. *A. Volkart*. (Sci. Agric., ix, 8 (April, 1929), pp. 510-521.) [63.33.]

Some Studies of Red Clover Varieties in Field Trials. *E. Jones*. (Welsh Jour. Agric., v (1929), pp. 138-143.) [63.33.]

The Ryegrass Seed Industry of Northern Ireland. *S. P. Mercer*. (Agric. Prog., vi (1929), pp. 56-60.) [63.1951; 63.33.]

Studies in Crop Variation: VI, Experiments on the Response of the Potato to Potash and Nitrogen. *T. Eden* and *R. A. Fisher*. (Jour. Agric. Sci., xix, 2 (April, 1929), pp. 201-213.) [63.3; 63.512-16.]

Early Potatoes. *W. B. Mercer* and *W. A. C. Carr*. (Agric. Prog., vi (1929), pp. 53-56.) [63.512.]

The Estimation of Yield in Cereal Crops by Sampling Methods. *A. R. Clapham*. (Jour. Agric. Sci., xix, 2 (April, 1929), pp. 214-235.) [37 (01); 63.31; 31.]

Malting Barley. *J. F. Wright*. (Jour. Roy. Agric. Soc. Eng., Vol. 89 (1928), pp. 16-22.) [63.313.]

The Effect of Barley Manuring upon the following Hay Crop. *H. Fail*. (Jour. Roy. Agric. Soc. Eng., Vol. 89 (1928), pp. 134-141.) [63.191; 63.313.]

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NOTES FOR THE MONTH

THE Agricultural Organizers' Conference met at Balliol College, Oxford, from July 26-31. The subject of the Conference was "Commercial Livestock."

**The
Organizers'
Conference**

The proceedings were opened on the evening of the 26th by a dinner at Balliol presided over by the Rt. Hon. Noel Buxton, M.P. (Minister of Agriculture), at which representatives of the University, the College, and of the Ministry were present in addition to Agricultural Organizers, Research Workers, Economists, Livestock Officers, and Breeders, Feeders and Auctioneers.

In a speech after the dinner, the Minister proposed a vote of thanks to the authorities of the University, and the College, for their hospitality in providing for the accommodation of the Conference. He said that in the view of the present Government agriculture was a business of the highest importance. While elected bodies were responsible for policy, the success of agriculture must depend to a large extent on the activities of the officers present. He referred to the great importance of education, and to the value of promoting it, especially with a view to improving the technical equipment of the labourer and of women who work on the land. The State, said Mr. Buxton, is spending about £300,000 a year on research, and Agricultural Organizers were the main channel by which the results of that research are conveyed to the producer. They were doing the vital thing in interpreting its value to the producers; there is the special function of the county educational staff.

The Parliamentary Secretary supported the Minister and urged that there was nothing more vital to England to-day than the restoration of the vigorous well-being of the countryside. A vote of thanks was passed to the University and the College Authorities. Mr. G. N. Clark, on behalf of the University, reminded those present that the University was also engaged in agricultural education and took a distinguished part in it. He was there not merely to extend an official

welcome, but to confess his firm belief in "book" farmers, among which eminent class he thought he could number all those present. Sir Harold Hartley, on behalf of Balliol, in thanking the Minister, said he should like to express the hope that the Conference would find itself in the right atmosphere for the discussion of education and research. He referred to the particular interest taken by the College in that Conference, because although its reputation rested very largely on its classical learning they were very proud of the fact that they had produced a number of men who took a prominent part in British agriculture.

The proceedings in the Hall terminated with a vote of thanks to the Minister for his speech, proposed by Mr. Green, the Agricultural Organizer for Lancashire, and seconded by Mr. Gregg, the Agricultural Organizer for Cornwall.

Two Sessions of the Conference were held on Saturday, Monday and Tuesday and one on Wednesday morning.

The subjects under discussion embraced "Breeding," "Feeding," "Type of Cattle, Sheep and Pigs best suited to present Market Requirements," and "Marketing." In each case opening papers were contributed by well-known authorities on their respective subjects, and in the discussions that followed academic and practical experts vied with each other in examining the problems disclosed and in propounding their own views.

It is hoped that in due course a complete summary of the papers and discussions will be published. In the meantime, brief reference may, perhaps, be made to some of the points raised. In opening the discussion on breeding, Professor Scott Watson reviewed the work of the early improvers and expressed the opinion that, in more recent years, there had been less improvement than might have been anticipated. He referred particularly to milk yields and to the disappointments resulting from efforts to improve yields by breeding and milk recording, and was inclined to ascribe some of the blame to a "show" system which is not altogether in accord with the lessons of genetics.

In the subsequent discussion it was pointed out that the incidence of disease and breeding troubles, such as sterility, were to some extent responsible for the apparent lack of progress; and, this notwithstanding, milk yields, generally, had undoubtedly gone up.

In referring to the popularity of the first cross for commercial purposes Professor Watson suggested that trials might be

made of a further cross in view of the well-known excellence of the progeny produced by crossing a Half-bred (Border Leicester X Cheviot) ewe by a Down ram. At the same time indiscriminate crossing was strongly to be deprecated.

Another question mentioned more than once in course of the Conference was that of the "scrub" bull. In general he had no supporters, but it became clear that the term "scrub" required careful definition. It was pointed out that an animal which is not pedigreed nor of the generally accepted "bull type" may yet, as regards transmission of milking capacity, prove more successful than an animal of unquestionable lineage.

The practice of judicious crossing was also strongly supported by pig breeders, a special plea being made for the Large Black sow mated with a Large White boar.

In the discussion which followed reference was made to the cost of rearing home-bred heifers up to the time they entered the dairy herd. Figures were quoted which compared unfavourably with prices payable for good-class stock raised in rearing districts, and it seems clear that more information is wanted on the subject of home-breeding and feeding of young stock intended for dairying.

Breeding difficulties such as sterility were dealt with by Mr. J. Hammond, who in his investigations with rabbits and, to a less extent, with mares had found that conception is dependent largely on the stage in the heat period at which service takes place.

Professor T. B. Wood elaborated a new method of computing rations according to the live weight increase required, and adaptable both to fattening and to breeding animals. Incidentally, Professor Wood indicated that the accepted standards for protein requirements in the feeding of dairy cows were on the high side, and that somewhat lower standards could be used without ill effects and with considerable saving in the cost of feeding.

In a further paper on feeding, Dr. Chas. Crowther described a number of experiments on pig-feeding, the objects of which were to find some basis for a ration cheaper than barley meal and sharps, to compare various products of animal and vegetable origin as sources of protein, and to determine the economic value of milk, whole and separated, when used in a pig ration.

Dr. J. B. Orr discussed the bearing of recent research on practical problems of feeding, with special reference to food

factors other than those concerned with the starch and protein ratio, more particularly, minerals. He enjoined caution in the interpretation of the results of academic research which, while absolutely essential for the fundamental basis of nutrition, may not be strictly applicable to practical conditions. There is, however, evidence to show that where deficiencies occur it is possible by making these good not only to increase production but to maintain the constitution of animals, and so decrease the present appalling range of disease in stock.

The type of animals suited to present market requirements was dealt with by Mr. Wm. Bruce, formerly of the East of Scotland College of Agriculture and now a practising farmer in East Lothian, by Professor R. G. White and other educational experts, as well as by such well-known authorities on the practical aspects as Col. Edwards, Mr. S. Pulham, Mr. Alfred Mansell, Mr. A. E. Marsh, and Alderman P. F. Astill. As regards "baby beef" it was shown that the progeny of dairy shorthorns when fed from birth gave results little, if any, inferior to those obtained from purely beef breeds, thus indicating that in the young animal, at least, beef "points" are largely a matter of nutrition.

In an exhaustive paper on "Marketing" Mr. Orwin reviewed existing arrangements and indicated their drawbacks from the farmer's point of view. He commented on the number of small markets, often operated by competing salesmen, with a resulting tendency towards the formation of "rings." He supported the idea of central abattoirs. At the same time he had a good word to say for the dealer in store stock who performed a useful function as the link between the feeders and rearers in districts remote from each other.

Subsequently the Ministry's scheme for the grading and marking of meat was described, and in the general discussion that followed Mr. A. P. McDougall referred to the rise and progress of Midland Marts Limited, Banbury, with which he has been prominently identified from the outset. Large marts, properly organized, attracted buyers from many centres and overcame many of the disadvantages from which the smaller local markets suffered. On the question of the dealer in store stock, one speaker cited instances of satisfactory working arrangements between rearers in one district and feeders in another.

The average numbers attending the Conference exceeded those in previous years, and the Members are particularly

indebted to Professor Peters for his courtesy in allowing the Sessions to be held in the Lecture Room of the Biochemical Laboratory. It is hardly necessary to say that all those who attended were appreciative of the advantages which the Conference enjoyed in occupying accommodation at Balliol.

Mr. P. G. Dallinger, O.B.E., Chief Inspector for Education, Ministry of Agriculture, acted as Secretary to the Conference.

* * * * *

INCLUDING the new farm institute at Borden, Kent (see page 562), which will be opened in October, there are now seventeen farm institutes in England and

Courses at County Farm Institutes

Wales. The primary object of these institutes is to provide instruction in the scientific principles underlying sound farming practice, and they have been specially and extensively equipped for the purpose. All the institutes, with one exception, have demonstration farms attached, and the instruction given is closely related to practice. This applies not only to general agriculture but also to gardening, dairying and poultry-keeping. The subjects dealt with and their order of importance vary somewhat at the different institutes, but a typical curriculum includes the following: soil, manures, crops, live stock, implements, farm book-keeping, general agricultural science (biology and chemistry), horticulture, dairying, poultry and bee-keeping, and fungus and insect pests. Most of the courses start in October, one term being taken before Christmas and one after; but in some cases a full year's course is provided. Facilities are also provided for short courses in special subjects, and most of the institutes provide instruction for women, particularly in such subjects as dairying, horticulture, and poultry-keeping.

The institutes are situated in the following counties: Cheshire (at Reaseheath, near Nantwich); Cumberland and Westmorland (at Newton Rigg, near Penrith); Essex (at Chelmsford); Hampshire (at Sparsholt, near Winchester); Hertfordshire (at Oaklands, St. Albans); Holland, Lincolnshire (at Kirton, near Boston); Kent (at Borden, near Sittingbourne); Lancashire (at Hutton, near Preston); Northamptonshire (at Moulton, Northampton); Somerset (at Cannington, near Bridgwater); Staffordshire (at Rodbaston, Penkridge); West Suffolk, the Chadacre Agricultural Institute (at Hartest, Bury St. Edmunds); East Sussex (at Plumpton); Caernarvonshire (at Madryn Castle, Bodfean); Carmarthenshire (at Carmar-

then); Denbighshire (at Ruthin); and Monmouthshire (at Usk, Newport).

A certain number of scholarships available at the institutes are awarded by the various County Councils to residents within their areas, and the Ministry itself awards scholarships for the sons and daughters of agricultural workers.

Brief particulars of the courses for the session 1929/30 are contained in a Form No. 732/T.E., which can be obtained from the Ministry; more detailed information will be furnished by the Principal of the Institute concerned. Anyone desirous of attending one of the courses commencing in October should make immediate application to the Principal.

* * * * *

RETURNS have now been received from the beet sugar factory companies in Great Britain showing the production and sales of sugar beet pulp manufactured during the 1928-29 campaign. The total figures,* compared with those for the previous campaign, are as follows :—

	Dry.		Wet.	
	1928-29	1927-28	1928-29	1927-28
	Tons.	Tons.	Tons.	Tons.
Total production	97,451	91,436	8,208	†16,163
Sold for use in U.K.	86,849	66,588	8,187	8,875
Exported	10,458	23,164	—	—
Losses owing to deterioration, etc.	144	1,684	21	6,488

†800 tons ensiled for experimental purposes.

A notable feature was the large demand for molassed-pulp, i.e. dried pulp to which molasses has been added, 44,540 tons being produced out of a total production of 97,451 tons of dried pulp. Under the beet contract, the grower was able to secure a quantity of dried pulp, equal to 5 per cent. of the tonnage of beets delivered, at £5 0s. 0d. per ton ex factory, provided he exercised this option by July 1. Some of the factories, however, as an experiment made a special offer of pulp to their growers at £5 0s. 0d. per ton delivered at their station, provided that the order was placed by an earlier date and that definite dates for delivery were agreed to. Under this scheme, a grower so ordering received an early-delivery rebate of 2s. per ton if delivery was taken in October, 1s. per ton if delivery was taken in November, while being liable to a charge of 9d. per ton in respect of deliveries not taken on the

* Excluding the production of the dessication process factory at Eynsham.

agreed dates. This scheme has been adopted by all the factories constituting the Beet Sugar Factories Committee of Great Britain for the years 1929 and 1930, orders being limited to quantities of not more than one ton per acre contracted for and grown. Surplus dried pulp not taken up by growers in 1928 obtained by sale in the open market an average price of £5 7s. 0d. per ton ex factory. The response by farmers was such that, of the total British production of dried pulp, 11 per cent. only was exported as against 25 per cent. in 1927-28 and 59 per cent. in 1926-27. In the majority of cases, exports were made only after growers' and home trade requirements had been satisfied, or to complete existing contracts outstanding from last season. In view of the increasing popularity of this valuable feeding stuff it seems likely that in the coming manufacturing campaign the home demand may exceed the supply.

Those growers, in areas outside the "growing radius" of the factories, who have made contracts with the Beet Sugar Factories Committee are reminded that the maximum railway freight charge on dried pulp purchased under the terms of their contract is limited to 15s. per ton.

* * * * *

THE conditions under which the Ministry is empowered to give financial assistance in the case of schemes of arterial drainage have recently been revised and the facilities somewhat extended. Grants are available both to Statutory Drainage Authorities and to County Councils, and the facilities are, briefly, as follows :—

**State Grants
for Arterial
Drainage**

Grants are available of either 50 per cent. of the net cost of the scheme, or 75 per cent. of the wages bill, at the option of the authority executing the scheme. These grants are available in the following cases :—

- (a) in areas suffering from severe and prolonged unemployment, provided that the unskilled labour is engaged at the nearest Employment Exchange, and
- (b) in other areas, provided that at least 50 per cent. of the labour is obtained through the Employment Exchanges from depressed areas selected by the Ministry of Labour. In exceptional cases a reduction of this 50 per cent. may be authorized.

All applications should be addressed to the Ministry at 10 Whitehall Place, London, S.W. 1, in accordance with the instructions which have already been circulated to all Drainage

Authorities and County Councils. Where, however, a scheme is of sufficient magnitude to involve the raising of a loan by the authority executing the scheme, the application will be passed by the Ministry to the Unemployment Grants Committee, whose grants are as follows :—

In the areas (a) above, 75 per cent. of the loan charges for the first half of the loan period up to 15 years ; and

In the areas (b) above, 75 per cent. of the loan charges for the first half of the loan period up to 15 years, and $37\frac{1}{2}$ per cent. of the loan charges for the second half of the loan period up to 15 years.

* * * * *

UNDER the auspices of the Empire Marketing Board, in association with the Ministry of Agriculture, the Experimental and Research Station at Cheshunt

**The Control of
Greenhouse
White-Fly
Pest**

distributes *free of charge* to owners of glasshouses and conservatories a Chalcid wasp (*Encarsia formosa*) which lays eggs within and destroys the young stages, known as “scales,” of the Greenhouse White-fly. The parasite itself is entirely harmless to plants, and is dependent upon the white-fly for its existence.

Application for Parasites.—In making application for the parasite, it is necessary only to write to the Entomologist, Experimental Station, Cheshunt, Herts, stating the number of glasshouses for which the parasite is needed and the type of plant which is infected by the white-fly pest. In the case of commercial nurseries where blocks of houses are concerned, it is advisable to state the number of houses in each block.

The Size of the Houses does not matter.—The most suitable months for starting the parasite are late March, April, May and early June.

Unless the glasshouses or conservatories are stocked with plants and kept heated during the whole winter, it is not advisable to apply for parasites on or after August 1 in each year.

Method of Distribution.—The scales of the White-fly in which the parasite has laid eggs are sent out to growers upon tomato shoots packed in cardboard boxes. On receipt, the grower with as little delay as possible merely ties the tomato-shoots into small bunches and hangs them up, preferably in shady places, in any houses in which he knows white-fly to be present. The bunches should be left hanging for a period of three weeks.

When an average temperature of 70°F. is maintained, the grower may expect to find black parasitized scales upon the underside of the low foliage of his plants from 14 to 21 days after the bunches have been hung up. If these do not appear he should write for another consignment of parasites.

At low temperatures the parasite is averse from laying its eggs in the white-fly scales when these are situated upon leaves of Tobacco, Datura, Eucalyptus, Bouvardia, Abutilon, and some varieties of Primula and Geranium. A high percentage of parasitism cannot therefore be expected upon these plants if grown under such conditions.

Immediate Control Measures.—In cases of severe infestations of white-fly, when immediate control measures are called for, the houses may be fumigated at night, preferably with sodium cyanide and sulphuric acid, one-eighth ounce cyanide being dropped into a jar containing one-half fluid ounce of 33 per cent. acid to every 1,000 cubic feet of space. The latter amount will kill the majority of adult flies, and will not harm the parasites within the scales, leaving the scales of the white-fly alive for the parasite to breed in.

Five fluid ounces of Tetrachlorethene (or fumigant containing this liquid) to every 1,000 cubic feet of space, poured upon the path of the house has the same effect, but cannot be used without grave injury to Chrysanthemums, Fuchsias, and certain varieties of Pelargonium.

Recognition of the Presence of the Parasite.—Scales of the white-fly containing the parasite are at once recognizable from normal scales by their jet-black colour.

They are readily distinguishable from the eggs of the white-fly, which appear as the minutest black specks to the naked eye, while the parasitized scales are as large as a small pin's head.

The parasite develops from the egg to maturity in about one month, and escapes through a roundish hole cut in the roof of the black scale-case. This hole can be seen by the unaided eye, if a leaf upon which emerged scales are situated is held up to the light. The scale turns black from 11 days to 3 weeks after the parasite egg is deposited in it.

The adult female parasite is a very minute insect with a pale yellow body: it may usually be found upon the underside of the upper foliage of plants upon which white-fly is breeding. When touched, the wasp jumps like a flea, and flies in the sun in a hovering manner. The male parasite has a dark body, and occurs only rarely when temperatures are low.

THE Ministry's Annual Report on the prices and supplies of agricultural produce and requirements in 1928-29 was issued last month. This report discusses

**Agricultural
Statistics, 1928
(Part II)**

the movements in prices of the different commodities during 1928, and price changes are compared over a series of years by means of index numbers. The Report shows that during the cereal year 1927-28 prices of agricultural produce averaged 47 per cent. above 1911-13, or the same as in the previous cereal year, while in the seven months September, 1928, to March, 1929, the index number declined to 42 per cent. above pre-war. Prices of feeding stuffs advanced from 33 per cent. in 1926-27 to 54 per cent. in 1927-28, and for the seven months September, 1928, to March, 1929, they averaged 47 per cent. above pre-war. Fertilizers averaged 3 per cent. below pre-war in the period September, 1928, to March, 1929, as compared with 1 per cent. and 13 per cent. respectively above in the cereal years 1927-28 and 1926-27.

The Report also contains references to agricultural wages, the prices of seeds and machinery, and the progress made under the Markets and Fairs (Weighing of Cattle) Act of 1926.

Tables are appended to the Report showing the monthly average prices in 1928 of most agricultural commodities, together with figures of the imports of livestock into Great Britain from Ireland, and of imports into the United Kingdom of all the chief classes of agricultural commodities.

The Report, which forms Part II of the Agricultural Statistics, may be purchased through any bookseller or direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 1s. 3d. net or 1s. 5d. post free.

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THE MINISTER has prepared draft Regulations under the Agricultural Produce (Grading and Marking) Act, 1928, prescribing grade designations and grade designation marks for English beef.

**Agricultural
Produce (Grading
and Marking)
(Beef) Regulations,
1929**

Copies of the draft Regulations, which will be cited as the Agricultural Produce (Grading and Marking) (Beef) Regulations, 1929, may be obtained from H.M. Stationery Office, Adastral House, Kingsway, W.C.2., price 1d. exclusive of postage.

THE PURCHASE OF MILK ON A QUALITY BASIS

THE general principle of bonus payments for milk of a high standard of cleanliness and butter fat content is becoming more popular throughout the country, and it may be of interest at the present time to review the main factors which have given rise to this system.

It is probable that, during the last twenty years, no industry has made greater progress and seen greater changes than has that concerned with milk. In pre-war days, milk was generally purchased by individual bargaining with producers and, with few exceptions, retail distribution was carried out by relatively small units. Under this system, dairymen were free to vary the price according to the standard of each producer's supply, and it was quite general for special services, such as veterinary examination of the herd, a general standard of cleanliness in production, and milk of high butter fat content, to command a higher price than that generally prevailing in the district.

During this period also, the Public Health Departments, dairymen and the public in general were slowly becoming more critical of the methods employed in the production and handling of milk. As a result, the Milk and Dairies Consolidation Act, 1915, was a definite attempt to unify milk legislation throughout the country and raise the general standard of the milk supply. On the outbreak of the war, further active development became impossible, and the price of milk was controlled at a standard level. It may be mentioned, however, that provision was made that producers who had established the practice of supplying milk of superior quality should be left free to obtain a price above the general level.

As one would anticipate, the post-war period has been one of transition in which numerous adjustments, adaptations and extensions can be recorded. On the legislation side, the 1915 Act came into force and was further supplemented by the Milk and Dairies Amendment Act, 1922, followed closely by the Milk (Special Designations) Orders of 1922 and 1923, and the more general and detailed Milk and Dairies Order of 1926. The Designations Orders followed naturally from the growth of special milk production which had definitely received recognition during the war period. This work had received support from Public Health Departments, the general public and, more particularly, from research and advisory services, which developed rapidly after the war.

Collective Bargaining and Bulking of Supplies.—A movement of wide general significance was that of collective bargaining between producers and the trade. This became advisable owing to the general increase in milk production, the rapid advance in transport, and the general tendency for the distributing trade to re-organize and amalgamate into larger working units. Under this scheme, definite minimum prices were suggested, and an attempt was made to differentiate between milk sold for direct consumption and that destined for conversion into products. It was not unnatural that the minimum price tended to become the maximum, and the main consideration from the dairymen's point of view was that of general accessibility and regularity of supplies.

These developments, together with the increasing adoption of distribution in bottles, resulted in the general practice of bulking farmers' supplies. This took place either at the distant collecting centres or at the town dairies where general processing was carried out, but in either case it had the effect of reducing the influence of each individual farm supply. Moreover, the adoption of a minimum price tended to do away with any incentive on the part of the producer to pay special attention to his methods of production, for as long as he delivered milk in a reasonable condition and above the legal standards of chemical composition nothing further was apparently necessary.

Improved Production.—During the same period, however, much progress was made along the line of improving farm milk production, and the results of research had enabled farmers to adopt definite principles and routine methods. The graded milk movement made steady progress and exerted an influence far beyond the actual gallonage handled. At the same time, County Authorities developed a general advisory service for producers and much useful work was undertaken through the medium of clean milk competitions, milkers' contests, demonstrations and individual farm visits. Moreover, facilities were made available for systematic testing of milk supplies, and by this means the quality of the milk from the cleanliness standpoint was no longer left in doubt, so that the influence of hygienic methods on the keeping properties of milk gradually attracted the attention of progressive dairymen.

During the summer months dairymen were experiencing considerable difficulty in maintaining a supply of milk which would keep sweet under all conditions of delivery and domestic storage. They relied to a great extent on mechanical means of control, involving elaborate equipment, central depots and the

use of heat and cold storage. It was not realized, however, that indiscriminate bulking of farm supplies rendered absolute control impossible, owing to the fact that a small percentage of unsatisfactory supplies would lower the general standard of the bulk. A few progressive dairymen, therefore, endeavoured to raise the general standard of their supplies, and to eliminate at all costs the worst producers. This naturally entailed the systematic testing of milk from each farm, and laboratory facilities became essential and tended to supersede the rough tests which were usually carried out on receiving platforms. Experience of this development proved that testing would not by itself have the effect of raising the standard of production to the desired level, and it became necessary to employ farm inspectors, whose main duties were of an advisory nature. A system of farm inspection and laboratory control of this kind is relatively costly—indeed it is a service that can only be maintained by large units—hence, many of the smaller dairies decided to encourage producers to make full use of the advisory services and the various competitions which were organized in the counties.

Preference for Best Producers.—This general movement has given rise at the present time to more than twenty schemes involving the principle of giving preference to the best producers and eliminating unsatisfactory supplies. These schemes vary somewhat in detail, but fall roughly into three main groups, as shown in the following statements, which give brief outlines of the various systems that have been adopted and are in practice to-day.

(1) *Bonus Payments on a Gallonage Basis in connexion with County Clean Milk Competitions.*

- (a) 2s. per 100 gallons to prize winners; 1s. per 100 gallons to winners of certificates; also cash prizes to employees and challenge cups for highest placed supplies.
- (b) 1d. per gallon to prize winners and $\frac{1}{2}$ d. per gallon to winners of certificates.
- (c) Half-yearly payments for milk supplied during previous six months, $\frac{1}{4}$ d. per gallon to first six suppliers in order of merit; if 60 per cent. of marks obtained, bonus increased to $\frac{1}{2}$ d. per gallon; if 70 per cent. of marks obtained, bonus increased to 1d. per gallon. Company pays entry fees.
- (d) Monthly payments of $\frac{1}{4}$ d. per gallon to first two suppliers in order of merit and $\frac{1}{4}$ d. per gallon to third and fourth; bonus is also paid to employees of the suppliers concerned. Payments are contingent upon the maintenance of a satisfactory fat content. Company pays entry fees.
- (e) 1s. per 100 gallons for milk which contains not more than 300,000 bacteria per c.c. with *B. coli* absent in 1/10 c.c. Similar payments to employees of suppliers concerned.

(2) *Schemes which provide for Money Prizes to Suppliers who enter County Clean Milk Competitions.*

- (f) Prizes of £10 and £5 respectively to the two suppliers who obtain the highest positions in a competition. Cash payments to the employees of the best three suppliers. Limited to unlicensed producers.
- (g) As above in all respects.
- (h) £20 divided among suppliers in order of merit.
- (i) £5 divided among suppliers in order of merit.
- (j) Entry fees paid for suppliers, and cash prizes awarded in order of merit.

(3) *Bonus Payments on Gallonage by Distributors conducting their own Testing and Advisory Service.*

- (k) Milk samples from each supplier tested about three times each fortnight for bacterial content, *B. coli* and fat content, and results tabulated in order of merit. 1d. per gallon bonus to first twelve suppliers and $\frac{1}{2}$ d. per gallon bonus to next twenty-four in order of merit; $\frac{1}{2}$ d. per gallon to all suppliers for each 0.5 per cent. of fat in excess of 3.5 per cent., 3d. per gallon extra is paid for Grade A (T.T.) milk. Suppliers of dirty milk are dispensed with.
- (l) Scheme is based mainly on efficient methods and butter fat content. Payments are as follows: 3d. per gallon extra for Grade A (T.T.) milk, 2 $\frac{1}{2}$ d. per gallon extra to producers with tuberculosis-free herds who hold county clean milk competition certificates; 30s. monthly for efficient steam sterilization; 1d. per gallon extra for milk containing 4.5 per cent. fat and over and $\frac{1}{2}$ d. per gallon extra for milk containing more than 4 per cent. and less than 4.5 per cent. fat. A deduction of 1d. per gallon is made in respect of milk of which the temperature on arrival exceeds 60° F.
- (m) Samples of evening milk tested for bacterial count and *B. coli*. Fortnightly surprise visits are paid to each farm and these inspections are taken into consideration in awarding a bonus. $\frac{1}{2}$ d. per gallon extra is paid for milk of the following standard:—bacterial count not exceeding 25,000 per c.c., with *B. coli* absent in 1 c.c.
- (n) Samples tested for bacterial count and *B. coli*, and marks awarded accordingly. 1d. per gallon extra is paid to suppliers obtaining 77 per cent. marks and $\frac{1}{2}$ d. per gallon extra when 64 per cent. marks are obtained; also 1/10d. per gallon for each 0.1 per cent. of butter fat above 3.5 per cent.
- (o) Quarterly samples tested for bacterial count, *B. coli* and fat. 10s. extra per 1,000 gallons is paid for milk which conforms with the following standard:—bacterial count not exceeding 250,000 per c.c.; *B. coli* absent in 1/100 c.c.; butter fat content 3.2 per cent. for morning milk and 3.8 per cent. for evening milk.
- (p) Fortnightly samples tested for bacterial count, *B. coli*, fat content and keeping quality, and marks awarded according to a scale. Monthly payments of 1d. per gallon extra to first three suppliers in order of merit; $\frac{1}{2}$ d. per gallon extra to next four; $\frac{1}{4}$ d. per gallon extra to next five.
- (q) Fortnightly samples examined for bacterial count and *B. coli*, and marks awarded. Fortnightly payments of 1d. per gallon extra to first ten suppliers in order of merit, providing 50 per cent. marks are obtained.

- (r) Fortnightly samples tested for bacterial count, *B. coli* and sediment, and marks awarded according to a scale. Fortnightly payments of $\frac{1}{4}$ d. per gallon extra to first three suppliers in order of merit and $\frac{1}{4}$ d. per gallon extra to next four, providing 50 per cent. marks are obtained.
- (s) Bonus of $\frac{1}{4}$ d. per gallon for cleanliness; particulars of standard and of testing not available.
- (t) Fortnightly samples tested for bacterial count, *B. coli*, fat content and keeping quality, and marks awarded according to a scale. Monthly payments of 1d. per gallon extra to first six in order of merit; $\frac{1}{4}$ d. per gallon to next four: $\frac{1}{4}$ d. per gallon to next three suppliers.
- (u) Samples tested regularly at Provincial centre. Payments of $\frac{1}{4}$ d. per gallon extra for milk conforming with "Certified" standard, and 1d. per gallon extra during eight months and $\frac{1}{4}$ d. per gallon extra during four months for milk conforming with "Grade A" standard.
- (v) Fortnightly samples tested for bacterial count and *B. coli*. Bonus payments of 1s. per 100 gallons for milk which conforms with the following standard:—bacterial count not exceeding 300,000 with *B. coli* absent in 1/100 c.c. Similar payments to employees of suppliers concerned.
- (w) Monthly surprise samples taken at depot and tested for bacterial count, *B. coli*, keeping quality, fat content, solids-not-fat and sediment, and marks awarded according to a scale. Deductions of marks are made for taints, sourness, etc., and also if the chemical composition is below the presumptive legal standard. The scheme does not apply to licensed producers nor to supplies of less than 10 gallons daily. Bonus payments of $\frac{1}{4}$ d. per gallon are made each month to the first twelve suppliers in order of merit. Annual Challenge Cups are offered to suppliers.

Although the exact details of the above schemes vary considerably, the general principle of payment for quality holds good. It will be noted that in some cases the schemes are at present linked up with clean milk competitions and other educational activities, and it is obvious that sooner or later some modifications will be necessary in order to place them on a definite commercial basis. At present, however, one of the main difficulties has been the lack of sufficient data to determine what is the actual additional expenditure incurred by producers who maintain continuously a high standard of production. It will be noted that in many of the schemes the actual bonus per gallon is small, and producers have stated that it is insufficient to meet the additional expenditure entailed. Nevertheless, a definite improvement has taken place and the interest of milkers has been aroused.

Benefits of the System.—The experience already gained seems to justify the conclusion that the movement is of mutual benefit to both producer and dairyman. In the case of producers it ensures financial recognition for efficient methods, provides

a useful and frequent check on the efficiency of the milkers, promotes a healthy rivalry among those who supply the same dairyman, and ensures the benefit of frequent advisory visits. To the dairyman it is a valuable insurance, serving to enhance the good-will of his business and laying the foundations of sound progress. He is in a position to determine the efficiency of each supplier and to eliminate unsatisfactory farms, thereby raising the general standard of his milk supply. He is able to detect any defects, either on the farms or in the dairy itself, and take the necessary steps to prevent serious complaints from the public. His improved standard will tend to reduce losses from souring to a minimum, and this in itself will promote increased sales. He will find that his suppliers will take a far greater interest in methods of production when systematic testing is carried out and the results published from time to time.

General Principles.—There is little doubt that this movement will extend and, in view of the wide variations in the details of schemes at present in force, it may be useful to suggest a few general principles which should be considered when introducing a bonus system of payment. In the first place, any scheme which is to be successful must receive the full moral support of the producers and the dairymen; to this end it must be fair, and bear some relation to the additional expenditure involved. For this reason it is suggested that bonus payments should be based on a definite standard rather than on a purely competitive basis. In the case of chemical standards, the results of a.m. and p.m. testing should be considered jointly.

The milk from each farm should be tested at reasonable and regular intervals, the bonus payment being awarded after each test rather than at the end of a six-monthly or yearly period. The result of each series of tests should be circulated among producers and their milkers in order to give adequate publicity to the movement and maintain the interest of suppliers. It is probable that all schemes will give preference to efficient producers, but it is equally important to ensure the elimination of inefficient supplies, as only thus can the general level be raised.

A further conclusion resulting from the experience so far gained is that a bonus scheme without an efficient advisory service will not produce the desired effect, and it is necessary to consider this aspect thoroughly in all cases. Finally, it is only fair to point out that such schemes should not be

associated with an increase in the retail price of milk to the consumer. It is realized, however, that, as the efficiency of milk production varies extensively on different farms, dairy-men would do well to reduce the risk of contaminating their main supply with milk from inefficient farms. They should accordingly offer every inducement and encouragement to their suppliers to improve their methods and to produce continuously milk of a recognized standard of quality.

* * * * *

GRADING AND MARKING OF ENGLISH WHEAT FLOUR

In the opinion of millers, bakers and others concerned in the manufacture and distribution of flour, the definition of national standards of quality and the marketing of supplies of standard qualities under distinctive marks would improve the demand for English wheat flour. It is proposed, therefore, to introduce a scheme for the voluntary grading and marking of English wheat flour under the Agricultural Produce (Grading and Marking) Act, 1928.

This Act enables the Minister of Agriculture and Fisheries to make regulations prescribing grade designations for any kind of agricultural produce and defining the quality indicated by such designations. The Act provides that where any person sells an article of agricultural produce to which a grade designation is applied, then, notwithstanding any contract or notice to the contrary, it shall be deemed to be a term of the contract of sale that the quality of the article accords with the statutory definition of the grade designation. The Act also enables the Minister to make regulations prescribing marks to represent grade designations, and any person who sells, delivers or exposes for sale an article marked with such a mark shall be regarded as using the grade designation represented thereby. No person may mark any article, covering or label with a statutory grade designation mark unless authorized to do so.

I.—Grade Designations and Definitions.—Grade designations and definitions as approved by various sections of the industry are set out in Appendix I, and are given statutory effect in the Agricultural Produce (Grading and Marking) (Wheat Flour) Regulations, 1929.* Flour sold under these standard grades

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price 1d., postage extra. (See p. 530 of this issue.)

will be guaranteed as to type, flavour and keeping quality and buyers will have the added satisfaction of knowing that it is essentially pure and has not been subjected to any kind of chemical treatment.

II.—The National Mark.—These Regulations also prescribe what has come to be known as the National Mark for use, with a grade designation, as a grade designation mark for English wheat flour of standard quality.

National Mark Committee.—In accordance with the Agricultural Produce (Grading and Marking) (General) Regulations, 1928, a National Mark Committee has been appointed by the Minister and empowered to issue authorizations to apply the Mark and to revoke or suspend any such authorization in individual cases in the event of non-observance of the conditions of the scheme.

National Mark Flour Trade Committee.—A Trade Committee, consisting of growers, manufacturers and distributors, has been appointed by the Minister to advise the National Mark Committee in regard to the issue of authorizations to apply the National Mark to All-English Flour.

Roll of Registered Packers.—Packers who undertake to comply with the conditions set out in (IV) below and are authorized by the National Mark Committee to apply the National Mark will be registered by the Committee and given a registered number in respect of premises at which they are authorized to apply the Mark. In the first instance, and until the scheme has passed the experimental stage, the right to apply the Mark will only be granted to packers whose total customary weekly output of flour of all kinds, packed and sold in the form of flour, is not less than 50 cwt.

Inspection Service.—The scheme is voluntary and the inspection necessary to safeguard the reputation of the National Mark should, therefore, be small compared with that required for a compulsory scheme. Moreover, manufacturers' and distributors' organizations may be expected to co-operate by reporting cases of default to the Ministry. The inspection service will be supplied by the Ministry.

III.—Supply of National Mark Labels.—Official labels bearing the National Mark and the grade designations will be issued to registered packers by or on behalf of the Ministry of Agriculture and Fisheries. A different coloured label will be used to distinguish each grade, blue, red and yellow labels being used to denote All-English Plain, Self-raising and Yeoman flours, respectively, and the labels will be of two

PART I.—*Flour made from sound, well-cleaned wheat grown in England and Wales : Grade Designations and Definitions.*

Grade Designation.	Definition of Quality.		
	Type.	General Characteristics.	Special Characteristics.
1.	2.	3.	4.
All-English (Plain) ..	The flour to comprise all the flours obtainable from the wheat, provided that the ash content as ascertained in a muffle furnace shall not exceed 0.55 per cent. by weight of the total flour.	Sound, free from taint or objectionable flavour, of good keeping quality and unbleached by artificial means.	Free from all added chemical substances.
All-English (Self-raising) ..	The flour to comprise all the flours obtainable from the wheat, provided that, before the addition of any ingredients referred to in Column 4, the ash content of the flour as ascertained in a muffle furnace shall not exceed 0.55 per cent. by weight of the total flour.	Sound, free from taint or objectionable flavour, of good keeping quality, and unbleached by artificial means.	May contain such ingredients or mixture of ingredients as may be required to make the flour self-raising, subject to the Regulations for the time being in force under the Bread Acts Amendment Act, 1922.

PART II.—*Flour made exclusively from sound, well-cleaned wheat of "Yeoman" varieties grown in England and Wales : Grade Designation and Definition.*

Grade Designation.	Definition of Quality.		
	Type.	General Characteristics.	Special Characteristics.
1.	2.	3.	4.
All-English (Yeoman) ..	The flour to comprise all the flours obtainable from the wheat, provided that the ash content, as ascertained in a muffle furnace, shall not exceed 0.55 per cent. by weight of the total flour.	Sound, free from taint or objectionable flavour, of good keeping quality, and unbleached by artificial means.	Free from all added chemical substances.

kinds, viz.:—tie-on labels for large sacks or bags and adhesive labels, of various sizes, for application to small retail packets. Labels may not be obtained from any unauthorized source and are not transferable.

IV.—Conditions of Enrolment as a Registered Packer.—Registered packers will be required to comply with the following conditions :—

- (a) The National Mark may only be applied by means of official National Mark labels, which are obtainable on payment and must be kept in safe custody.
- (b) National Mark labels may only be applied of the kind and in the manner approved as suitable for the size and type of package. Each label will bear the registered number of the packer and may also, if desired, bear the trade name of the packer.
- (c) Labels will be serially numbered at the time of issue, and packers will be required to keep a record of the serial numbers used daily.
- (d) The quality of the contents of each package to which a National Mark label is applied must conform to the statutory definition set out in Appendix I, according to the grade designation appearing on the label.
- (e) Where any registered packer obtains All-English flour and repacks it in containers bearing the National Mark, the flour obtained and used for this purpose shall likewise at the time of delivery to such packer bear the National Mark. Registered packers who acquire All-English flour for re-packing under the National Mark shall keep a record showing the receipts of flour bearing the National Mark and the following particulars in regard to each consignment received, viz., date, quantity, grade, serial number of labels and registered number of the original packer.
- (f) A registered packer must allow his packing premises and all equipment and records to be inspected at any reasonable time by any officer of the Ministry of Agriculture and Fisheries authorized in that behalf and, if so required, must allow any such officer to be present when National Mark flour is being milled or packed, to take samples of wheat going forward to be milled, and to inspect at any reasonable time and place, and to draw samples from flour packed or intended to be packed by such registered packer as National Mark flour. Millers of National Mark flour will be required to keep, for a prescribed period, samples of the wheat actually used in each gristing of National Mark flour. Similarly, packers of All-English (self-raising) flour will be required to keep samples of the plain flours used in the preparation of each lot of self-raising National Mark flour.

V.—Application for Enrolment.—The scheme is open to millers and other packers of English wheat flour. Any person or firm desiring to be authorized to pack under the scheme should obtain a form of application from the Secretary, National Mark Committee, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

VI.—Suspension or Revocation of Authorizations : Provision for Appeal.—The National Mark Flour Trade Committee will deal with complaints regarding supplies packed under the Mark, and in the event of this Committee recommending that the authorization granted to a registered packer should be suspended or revoked, the packer concerned, who will be so informed, will have the right of appeal to the National Mark Committee when that Committee considers the recommendation.

VII.—Date of Introduction of Scheme.—The scheme will come into operation on October 1, 1929.

NOTE.—*The above article is issued separately as Marketing Leaflet No. 12, a copy of which may be obtained, on application, from The Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.*

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THE LONG ASHTON TAR-DISTILLATE WASH: FIELD EXPERIMENTS, 1929

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and

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IN the issue of this JOURNAL for November, 1928, the writers gave details of field experiments with a new form of tar-distillate wash. This wash was prepared according to a formula devised by Mr. F. Tutin as a result of his investigations into tar-oil washes carried out at the Long Ashton Research Station.

The outstanding result described in this JOURNAL was the satisfactory commercial control of Capsid Bug on apples by means of the Long Ashton spray, used at a strength of 10 per cent. Other results demonstrated that the Long Ashton spray, even when used at 6 per cent. strength, was superior to the proprietary wash used as a "standard," but that in this case neither could be said to have given a satisfactory control of Capsid Bug.

Further and more extensive trials were carried out during the winter 1928-29, to ascertain if similar results could be secured under widely varied conditions. In order to do this as thoroughly as possible, the trials were distributed throughout the principal fruit-growing areas of England, the cost being met by a special grant from the Ministry of Agriculture.

The results of these trials, which are deemed to be of such

importance that they should be brought to the notice of growers at the earliest opportunity, are therefore summarized in a preliminary report. A more complete report will be published in due course.

The writers wish to acknowledge much assistance given by Advisory Officers, County Staffs, growers and others.

Field Trials, 1929.—These trials were planned to include apples, plums and black currants.

(a) *Apples.*—The results shown in Table I were obtained from eleven centres ranging over nine counties.

The varieties sprayed included Allington, Bramley, Bismarck, Cox's Orange Pippin, Early Victoria, Grenadier, Jubilee, James Grieve, King Edward, Lane's Prince Albert, Lord Derby, Newton Wonder and Prince's Pippin. Each of these was being grown under commercial conditions.

These trials were directed principally to the commercial control of the Apple Capsid Bug (*Plesiocoris rugicollis*) in the egg stage, but observations were included on Aphis, Psylla and Caterpillars. The washes tested comprised not only (1) the Long Ashton wash* as used in the trials of 1927-28 (already mentioned), but also (2) a modification of this wash, prepared by a commercial firm, in which the tar-distillate used was

* The composition and method of preparation of this wash has been described by F. Tutin in the 1927 Annual Report of the Long Ashton Research Station. In the 1928-29 trials, dealt with in the present paper, the amount of the emulsifier (Agral W.B.) used was double that given in Tutin's original paper in order to make the wash more suitable for use with a wide range of waters. This form of the spray is a two-solution wash, the addition of a solution of caustic soda being necessary to effect complete emulsification.

The spray so composed is applicable for use with the waters found in most fruit-growing areas; but a special problem arises in the case of the Wisbech area owing to the local peculiarities of the water supply. To meet this particular case, a modified form of the Long Ashton wash has been devised and introduced by a commercial firm. This is a one-solution wash and is referred to in the present paper as the modified Long Ashton wash.

(Both the emulsifier, Agral W.B., and the modified Long Ashton wash will, it is understood, be placed on the market in quantity for use during the coming spraying season.)

For convenience of reference the names "Long Ashton wash" and "Modified Long Ashton wash" are used in this paper for the two-solution and one-solution washes respectively.

Mention should be made of the fact that the "L.A." and "S." washes both contained the same percentage of tar-oil, whilst the "Mod. L.A." contained a lower percentage; hence the use of the last-mentioned at 12 per cent.

Further information on these washes can be obtained on request from the Director of the Agricultural and Horticultural Research Station, Long Ashton, Bristol.

TABLE I.—APPLIES. (Capsid Bug Markings on Trusses)

	Centre	Date		Examination	Controls	Percentage trusses marked by Capsid Bug							
		Applica- tion				12 per cent. S.	10 per cent. S.	12 per cent. Mod.L.A.	10 per cent. Mod.L.A.	6 per cent. Mod.L.A.	10 per cent. L.A.	8 per cent. L.A.	6 per cent. L.A.
I	Stawell (Somerset)	..	Jan. 22 Feb. 8	May 14	70	—	60	10	20	50	0	10	40
II	Crophthorne (Worcs)	..	Jan. 17 Feb. 22	May 6	30	—	10	—	5	10	Trace	—	5
III	Hampton (Worcs)	..	Feb. 11 Feb. 22	May 6	76	—	50	—	10	40	0	—	10
IV	Newnham (Glos)	..	Feb. 4-5	May 13	23	—	16	—	Trace	23	0	—	12
V	Topsham (Devon)	..	Feb. 8	June 12	40	—	30	—	Trace	—	Trace	—	—
VI	Falmouth (Cornwall)	..	Feb. 6	June 13	Trace	—	Trace	—	Trace	—	0	—	—
VII	Crookenhill (Kent)	..	Mar. 8	May 24	13	—	10	—	Trace	—	0	—	—
VIII	Wilmington (Kent)	..	Mar. 9	May 24	93	—	30	—	5	—	10	—	—
IX	Sompting (Sussex)	..	Feb. 23	May 23	52	—	50	—	14	21	—	—	—
X	Friday Bridge (Isle of Ely)		Mar. 6-7	May 28	42	18	35	6	10	—	—	—	—
XI	Burwell (Cambs)	A	Mar. 6	May 29	30	10	8	6	8	—	—	—	—
		B	Mar. 8	May 29	16	—	7	—	7	—	—	—	—

TABLE II.—APPLES. (Capsid Bug Markings on Fruitlets)

Centre	Date	Examina- tion	Controls	Percentage young fruit marked by Capsid Bug			
				0 per cent. S.	10 per cent. Mod. L.A.	8 per cent. Mod. L.A.	6 per cent. L.A.
II	Cropthorpe (Wores) . . .	Jan. 17 Feb. 22	66	40	18	30	6
III	Hampton (Wores) . . .	Feb. 11 Feb. 22	55	43	8	32	5
IV	Newham (Glos) . . .	June 17 June 22	66	38	10	23	4
V	Topham (Devon) . . .	Feb. 8 June 12	90	50	5	Trace	12

identical with that employed in the preparation of the Long Ashton wash, but in which the method of emulsification differed, and (3) a well-known proprietary brand of tar-distillate wash, used as a "standard," as in 1927-28.

The dates of application ranged from January 17 to March 9, 1929. It will be noted in Table I that, at certain centres, two dates are given; this is due to the fact that certain difficulties arose in connexion with the delivery of the Long Ashton wash. The earlier date in each case refers to the application of the modified Long Ashton wash and the later to that of the Long Ashton wash. It may be recalled that exceptionally bad weather conditions prevailed practically throughout the period of application, and as a result considerable difficulties in the satisfactory application of the washes were experienced.

In the lay-out of trials, control plots were duplicated or triplicated so as to have unsprayed plots available for comparison in the immediate vicinity of any particular sprayed plots.

The methods of estimation of results were as follows. In the case of Capsid Bug, estimations by eye were made first of all; these were followed, in the majority of cases, by actual counts made by means of tally registers. A random sample of 500 was taken as the standard number, but where any such count did not closely agree with the previous eye estimate, further samples of 500 or more were taken. This method was applied in the first place to trusses for the estimation of leaf damage, and later to fruitlets for Capsid Bug markings (shown in Table II). The results for mature fruit, together with crop weights, will be obtained and published later.

(b) *Plums*.—In this case the information is not so complete owing to the absence of Plum Aphid on any of the trees

under trial. Caterpillar was present and some definite results were collected. Three centres were used. The varieties included Bello de Louvain, Czar and Prolific.

(c) *Currants*.—Here again Aphid was present at only one of the three trial centres, and even then was irregularly distributed. Capsid Bugs were present at all centres, as also were Caterpillars, and some definite results were forthcoming. The varieties were Baldwin and Edina.

Strengths of the Washes.—The strengths employed for the three washes were as follows:—

Apples: Proprietary wash used as "standard" (S.) :—
12 and 10 per cent. strengths of Long Ashton Wash (Mod. L.A.) :—
12, 10 and 6 per cent. strengths.

Long Ashton Wash (L.A.) :—
10, 8 and 6 per cent. strengths.
Plums: Proprietary wash used as "standard" (S.) :—
6 per cent. strength.

Modification of Long Ashton Wash (Mod. L.A.) :—
6 and 3 per cent. strengths.

Currants: Proprietary wash used as "standard" (S.) :—
10 per cent. strength. Wash (Mod. L.A.) :—
Modification of Long Ashton Wash (Mod. L.A.) :—
10 and 3 per cent. strengths.

Long Ashton Wash (L.A.) :—
10 and 6 per cent. strengths.

Results.—I. *Apples*. (a) Apple Capsid Bug (*Plesiocoris rugicollis*): The results obtained are set out in Tables I and II. Table I refers to leaf marking, which is stated as a percentage of trusses marked. Table II treats of young fruit markings in the same manner. It will be observed that the figures given show a very consistent improvement in the degree of control of this pest as compared with any other washes previously tested.

(b) Caterpillars, Aphid and Apple Sucker: The general

results obtained were excellent, and of the same order as shown in the above tables. Actual figures are omitted from this paper, which is principally designed to demonstrate the results obtained against Capsid Bugs. The caterpillar attack on the control plots at all centres was exceptionally severe.

Among the definite results obtained the following may be stressed :—

- (a) All the sprays at all strengths used effected complete control of Aphis and Apple Sucker.
- (b) As regards caterpillars it was shown that good commercial controls were obtained by all three sprays at 10 per cent. strength.

At 6 per cent. strength, the proprietary wash (S) did not give this commercial control, but the Long Ashton wash (L.A.) gave results equal to those obtained by the 10 per cent. proprietary wash (S).

The Modified Long Ashton spray (Mod. L.A.) gave results slightly inferior to the Long Ashton (L.A.) spray at the same strengths.

At 10 per cent. strength the Long Ashton spray (L.A.) gave a markedly superior control as compared with the proprietary spray (S) at the same strength.

II. Plums.—(a) Aphis : As already stated no results were obtained owing to absence of the pest.

(b) Caterpillars : The results were equivalent to those given above for apple.

III. Black Currants.—(a) Capsid Bugs (largely *P. rugicollis* but some *Lygus pabulinus* present) : At Centre I (Dunnington, Wores.) the figures obtained for Capsid Bugs were as follows :—

Plot	Estimated percentage of leaves marked		
First Control	70
10 per cent. L.A.	20
10 per cent. Mod. L.A.	30
10 per cent. S.	60
Second Control	60

Two other trials at Cheltenham and Newnham gave similar results, but details are omitted here for the sake of brevity.

(b) *Aphis* : The position with regard to aphis has already been stated. It is worthy of note, however, that at the centre where aphis was present it was controlled by the Modified Long Ashton spray (Mod. L.A.) at 3 per cent. strength. The proprietary spray (S) and Long Ashton spray (L.A.) were not applied at 3 per cent. strength.

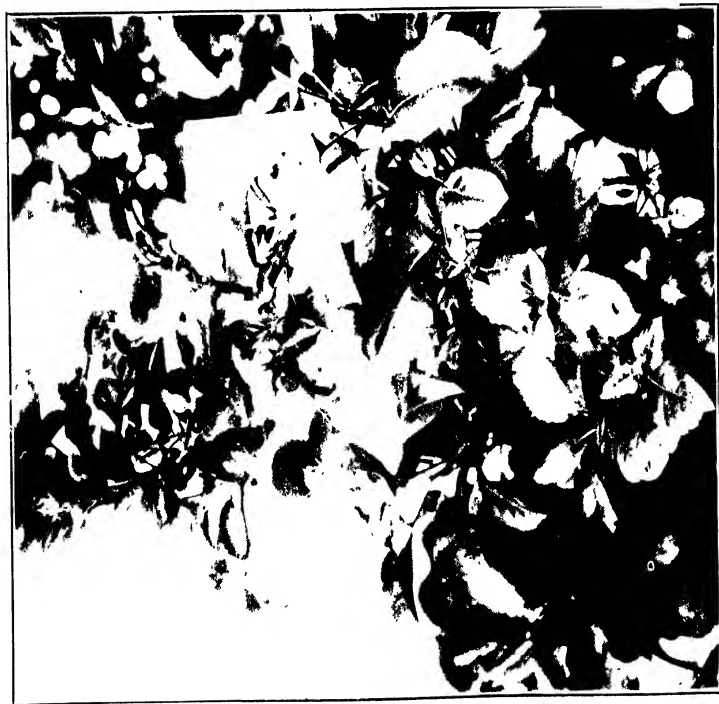


FIG. 1.—Early Victoria tree sprayed with the Long Ashton Tar-distillate spray at 10 per cent. strength. Photograph taken June 3, 1929, at Centre 1 (Stawell, Somerset). Note freedom from all pests, including Capsid Bug.



FIG. 2. Unsprayed tree adjoining that shown in Fig. 1 at Centre 1, photographed on same day. Note severe caterpillar and Capsid injuries to foliage. The blossom, it should be noted, was damaged by frost at this Centre.



FIG. 3.— Sample branch of Princes Pippin tree, at Centre 111 (Hampton, Wores) from block of trees sprayed with the Long Ashton Sprax at 10 per cent strength. Photographed June 17, 1929.
Note clean fruit and foliage.



FIG. 4.— Sample branch from tree, adjacent to that shown in Fig. 3, from a block of trees unsprayed. Note severe caterpillar injury to leaves and Capsid bug damage to fruitlets.

General Summary of Results.—(1) *Apple Capsid Bug* (*Plesiocoris rugicollis*): The results given in Tables I and II show clearly that the Long Ashton spray at 10 per cent. strength gave a consistent control of such a high order that further spraying in the spring for this pest was rendered unnecessary.

(2) *Caterpillars*: The results also demonstrate that the Long Ashton spray at 6 per cent. strength, and the Modified Long Ashton spray at the same strength, give an effective commercial control of all caterpillars present in the egg stage at the time of application. It may be recalled that hitherto tar-distillate washes have had to be used at 10 per cent. strength in order to effect similar control. The above remarks apply equally to caterpillars on apples, plums and black currants.

(3) *Capsid Bugs* (*P. rugicollis* and *Lygus pabulinus*) on *Currants*: Although a useful commercial control was obtained by the use of the Long Ashton spray at 10 per cent. strength, the results were not of the same high order as those obtained against Capsid Bug on apples.

Recommendations.—In view of the results obtained, the following recommendations are made, concerning the use of tar-distillate sprays based on the Long Ashton formula :—

(1) *Apples*

- (a) Where trees are infested with Capsid Bugs, the spray at 10 per cent. strength during the dormant season (December, January or February) should be used.
- (b) Where Capsid Bugs are absent, the spray at 6 per cent. strength should be used.

(2) *Plums*

In view of the effectiveness of the Long Ashton spray at 6 per cent. strength against caterpillars and aphids, this strength is advised. The effect of the spray at lower strengths is being investigated.

(3) *Currants*

Where Capsid Bugs are present, the spray should be used at 10 per cent. strength. If Capsid Bugs are not present, 6 per cent. strength should be used.

FERTILIZER TRIALS ON THE ORDINARY FARM

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WHILE the development of field experimental technique at our larger research institutes proceeds apace, it is, still true to say that many experiments up and down the country are of the old single plot type. This is due to the fact that trials which it is possible to carry out with the resources of the large station are impracticable on the ordinary farm, where the organization and supervision are at a minimum. It is not realized that the results of such experiments, even when not mutually contradictory, are so lacking in precision as to be of little value, and that the time and money spent thereon are often wasted. Recent experience goes to show that it is possible to lay down satisfactory field experiments of the modern type at isolated centres, and to carry these through from beginning to end with the minimum of skilled assistance. Thus, for some time past, it has been the policy of the Rothamsted Experimental Station to conduct experiments on private farms in order to examine certain fertilizer problems under varying conditions of soil and climate. Largely through the assistance of the County Organizers these experiments have been, fortunately, placed with farmers who have taken great interest in the particular problems, and who, by willing co-operation, have done much to ensure success. Although, at the outset, the experiments were of an essentially simple type, the last three or four years have marked a great advance, culminating in a very full and ambitious programme for 1928, and in plans for a still wider series of experiments in 1929. It is proposed to discuss here the lay-out and results of a selected number of these experiments, to indicate how in certain cases the results of a number of years can be taken together to give increased precision, to examine the effect of the variable time element, and finally to say what is possible with the limited resources generally available to the experimenter.

The first experiments of the modern type laid down at outside centres were those conducted under the auspices of the Basic Slag Committee, begun in 1926 and continued each year since. They were designed to compare the modes of action of slags of differing citric solubilities on hay, arable and root crops. In all cases save one there were four comparisons, a control plot being compared with three others treated with low, medium and high soluble slags respectively. There were

sixteen plots in all, each treatment and control being replicated four times. The plots were arranged in the form of a Latin square, so that each treatment occurred once in each row and once in each column, the arrangement, subject to this restriction, being at random. In one experiment, a fifth treatment was added, namely, superphosphate, and five replications of each were laid down, there being 25 plots in all. As an example, the 1926 results of this experiment, when the crop was swedes, may be taken.

BASIC SLAG ON SWEDES

Farm: Mr. Hyatt, Andoversford, Glos., 1926 (conducted by Mr. C. Comely). (Basic Slag Committee Trial.)

Soil: Loam on limestone (Lower Oolite).

System of Replication = 5×5 Latin square.

Area of each plot 55×72.75 links = $\frac{1}{15}$ acre.

Treatments: C = Control—no application of phosphate.

S = Superphosphate at rate of 100 lb. P_2O_5 per acre.

L = Low soluble slag (37.3 p.c.)

M = Medium soluble slag (60.9 p.c.)

H = High soluble slag (86.8 p.c.)

Equivalent
to
superphosphate

All plots received 12 loads dung + 1 cwt ammonium sulphate and 1 cwt. muriate of potash per acre.

	C 724	S 1132	H 1067	M 1031	L 923	Total 4877	Mean 975.4
	L 915	C 824	S 1123	H 1053	M 1037	4952	990.4
	S 1024	H 886	M 977	L 881	C 745	4513	902.6
	M 879	L 722	C 683	S 1025	H 947	4256	851.2
	H 1035	M 904	L 877	C 757	S 929	4502	900.4
Total	4577	4468	4727	4747	4581	23100	4620.0
Mean	915.4	893.6	945.4	949.4	916.2	4620.0	924.0

The letter represents the treatment, while the figure gives the actual yield in lb. (roots and leaves weighed together).

Treatment Yields in lb.

	Control	Low Soluble	Medium Soluble	High Soluble	Super- phosphate
Total ..	3733	4318	4828	4988	5233
Mean ..	746.6	863.6	965.6	997.6	1046.6

Results

Average yield	C	L	M	H	S	Mean	Standard error
Tons per acre	8.3	9.6	10.8	11.1	11.7	10.3	0.26
Per cent. ..	80.3	93.5	104.5	108.0	113.3	100.0	2.53

It can be seen at once that the treatments arrange themselves in order of citric solubility, and that all have produced a significant increase over the control plot, the superphosphate doing best of all. Of the intermediate differences (taking three times the standard error as significant) we see that medium, high and super are significantly better than low, while again superphosphate is significantly superior to medium and low. On the whole there are good grounds for supposing that in this, the first year of experiment on the slag treated land, the yield of swedes increased with the increasing citric solubility of the slags employed, but that none did so well as the plot treated with superphosphate.

Information from Experiments Continued over a Number of Years.—An experiment similar to the last, but carried out on permanent hay land, is capable of furnishing extra information as to the effect of seasonal change when conducted over a number of years. While each experiment, if designed and carried out as described in this paper, is a self-contained unit, and may be modified in subsequent years in the light of what has already been discovered, or to test new questions, it sometimes happens that the experiment remains unchanged for a number of years. This was the case with the experiment laid out in 1926 at the farm of Mr. B. W. H. Pratt, Old House Farm, Brooke, Norfolk. The arrangement was a 4×4 Latin square, with plots $\frac{1}{4}$ acre, designed to test the value of low, medium and high soluble slags respectively on meadow hay. The random arrangement was decided and the slags applied in that year, since when no change has been made. It is therefore possible to supplement the information available in the individual results for the three years by re-examining all the yields together, as is done in the following analysis.

BASIC SLAG ON NEW MEADOW HAY

Farm: Mr. B. W. H. Pratt, Old House Farm, Brooke.

Sown down in 1925, Plots each 99×110 ft. = $\frac{1}{4}$ acre.

Slags applied with distributor on March 31, 1926. Rate of application 100 lb. P, O, per acre in the form of low, medium and high soluble slags, as in Swede Experiment. Soil, calcareous boulder clay.

Plan of Experiment

L	H	C	M
H	C	M	L
C	M	L	H
M	L	H	C

Actual weights of hay in lb.

1926				1927				1928			
1187	1583	1194	1367	649	871	499	963	621	722	336	584
1224	1154	1227	1230	780	449	735	606	813	389	537	420
1317	1086	1439	1523	554	809	752	904	513	677	522	599
1488	1241	1595	1450	841	790	999	607	680	560	720	430

Summaries of results for Separate Years

Year	Average yield	C	L	M	H	General mean	Standard error
1926	Per acre cwt. . .	45.7	45.5	46.1	52.9	47.6	2.56
	Per cent. . .	96.0	95.7	97.0	111.2	100.0	5.38
1927	Per acre cwt. . .	18.8	25.0	29.9	31.7	26.4	1.06
	Per cent. . .	71.4	94.7	113.4	120.4	100.0	4.00
1928	Per acre cwt. . .	14.9	19.0	22.1	25.5	20.4	0.92
	Per cent. . .	73.1	93.1	108.6	125.1	100.0	4.52

Note first the preponderating effect due to "season." This is undoubtedly due, as observation on the field showed, to a dying out of certain constituent grasses and clovers of the seeds mixture after the first year. As far as treatment is concerned, in 1926 the hay did not respond at all to the dressings of low and medium soluble slag applied the same year, but responded in a marked manner to the high soluble slag. We suppose this to be because the high citric solubility of this slag rendered it speedily available in the soil as a plant nutrient, while the others were much slower in action, for, in the following year, both low and medium soluble slags gave a significant increase in yield of hay over the control plot. This result is in accordance with what has been found elsewhere, and illustrates the necessity of carrying on such experiments for a number of years before drawing conclusions. We may now, noting this seasonal effect, reinforce the separate results by averaging for the three years, as is done in the following table.

Results—Hay, Brooke, 1926-28

Average yield per annum	C	L	M	H	Mean	Standard error
Cwt. per acre . .	26.5	29.8	32.7	36.7	31.4	1.02
Per cent. . .	84.2	94.9	104.1	116.8	100.0	3.25

Summary.—The treatments arrange themselves in order of citric solubility, and the difference between any two is significant.

Experiments on Potatoes.—Two 16-plot experiments, of the Latin square type, were laid down to test the effect of superphosphate in promoting the growth of potatoes. One of these, conducted on the farm of Mr. G. Major, at Stowbridge, Norfolk, was remarkable both for the high yield obtained and the extreme accuracy of the results. The standard error was only 1.54 per cent., which made it possible to say that superphosphate had been instrumental in improving the yield even at this high level, although the actual increases were small. This result could not possibly have been detected by an experiment of the older type. A basal dressing of 4 cwt. sulphate of ammonia and 4 cwt. sulphate of potash per acre was given, and the treatments were 0, 2, 4 and 8 cwt. superphosphate per acre.

Results : Superphosphate on Potatoes

Average yield		No Super	2 cwt. Super	4 cwt. Super	8 cwt. Super	Mean	Standard error
Tons per acre	..	17.0	17.3	17.5	17.8	17.4	0.27
Per cent.	.. ..	97.6	99.6	100.8	102.0	100.0	1.54

An interesting departure from routine practice was an attempt to repeat the Rothamsted potato experiment of 1927 on the farm of Mr. J. H. L. Luddington, at Magdalen, Norfolk. Here no fewer than 81 plots, of $\frac{1}{8}$ acre each, were laid down to test sulphate of ammonia and sulphate of potash in varying quantities and in all combinations. Aided in supervision by three voluntary assistants, the authors found it possible with the labour available to harvest this area, and an extra half acre of 16 plots laid down to test superphosphate, in two days. The standard error is high, being accounted for to a large extent by working errors necessarily present where the work is carried out at a distance by a number of voluntary workers, and has to be performed at the ordinary commercial pace. It was our first experience of dealing with a large number of plots, and the results are encouraging. We have every reason to anticipate still more accurate results from trials of this nature carried out in the future. The plan and yields are given below :—

System of Replication : 9 Randomized Blocks of 9 plots each.

Area of each plot : 61 links (along row) \times 20.5 links = .0125 acre.

Treatments : All plots received superphosphate at the rate of 4 cwt. per acre. Sulphate of Ammonia and Sulphate of Potash at the rates of 0, 2 and 4 cwt. per acre were applied in all combinations, giving nine treatments in all, one of which was the control.

A			B			C			
4 0 273	2 0 329	2 4 263	2 0 250	4 2 286	0 0 230	2 0 295	0 4 209	2 2 289	
0 4 258	2 2 261	4 2 309	4 4 238	4 0 323	2 4 374	2 4 180	4 4 265	0 0 201	
4 4 268	0 0 157	0 2 215	0 2 219	2 2 301	0 4 267	4 0 222	4 2 244	0 2 233	
2 2 257	0 2 184	4 0 271	2 2 281	4 2 327	4 0 311	4 4 248	2 2 269	0 2 254	
D 4 2 299	2 4 259	0 4 192	2 4 312	2 0 271	0 2 209	0 4 217	2 0 379	2 4 240	F
4 4 289	2 0 270	0 0 246	4 4 314	0 0 226	0 4 197	0 0 203	4 0 172	4 2 297	
0 0 286	0 2 217	4 0 300	2 0 276	2 4 240	4 4 283	0 4 180	2 4 204	4 2 260	
0 4 187	2 0 254	2 2 232	4 2 286	0 2 162	4 0 313	0 0 201	0 2 192	4 0 276	
4 4 258	4 2 308	2 4 239	2 2 228	0 0 181	0 4 288	2 2 230	2 0 254	4 4 306	
G			H			J			

First upper figure = amount of Sulphate of Ammonia.
 Second upper figure = amount of Sulphate of Potash.
 Lower figure = yield in lb.

Treatment Yields in lb.

Sulphate of Potash		Sulphate of Ammonia			Total	Mean
		0	2	4		
	0	1931 214.6	2578 286.4	2461 273.4	6970	258.148
	2	1885 209.4	2348 260.9	2616 290.7	6849	253.7
Total Mean	4	1995 221.7	2311 256.8	2469 274.3	6775	250.926
		5811 215.2	7237 268.037	7546 279.481	20594	254.247

The upper figure is the total while the lower is the mean.

Block Totals in lb.

A	B	C	D	E	F	G	H	J	Total	Mean
2333	2488	2138	2267	2448	2279	2281	2257	2103	20594	254.247

The analysis tells us that the preponderating effect is that of sulphate of ammonia, which accounts for most of the variation between plots of the same block. Sulphate of potash has had singularly little effect. Reference to the table of the nine treatment means, for which the standard error is 12.64, shows that the nitrogenous effect is almost wholly due to the single dressing. The double dressing of 4 cwt. per acre has produced little, if any, further increase. It is also obvious that the potash means do not differ at all, when examined in the light of a standard error of 12.64 lb. For final tabulation purposes, therefore, it is unnecessary to do more than quote the three mean yields at the different sulphate of ammonia levels, the standard error appropriate to this comparison being 7.30 lb. Expressed first in tons per acre and secondly as a percentage of the general mean 254.25 lb., we have :—

Results : Sulphate of Ammonia on Potatoes, 1928

Average yield	No Sulphate	2 cwt. Sulphate	4 cwt. Sulphate	Mean	Standard error
Tons per acre ..	7.7	9.6	10.0	9.1	0.26
Per cent. ..	84.7	105.4	109.9	100.0	2.87

Summary.—Potash produced no effect, while there was a significant response only to the single dressing of nitrogen.

While not designed to test the effect of superphosphate, the application of 4 cwt. per acre was justified by the marked response obtained on an adjoining area, where a yield of 8.1 tons per acre was increased to 12.6 tons at the highest level (8 cwt. per acre) of superphosphate. This effect was confirmed at other centres, although not to the same marked degree.

Experiments on Sugar Beet.—An experiment was laid down in 1928 at the farm of Colonel Wilson at Colchester, to compare the action of different nitrogenous fertilizers on sugar beet. This was a particularly interesting experiment because it raised the question of what to do with an experiment when one or more plots have to be discarded. Five treatments were arranged in the form of a Latin square, control, and 60 lb. of nitrogen in the form of (i) sulphate of ammonia, (ii) muriate of ammonia, (iii) cyanamide alone, and (iv) two-thirds cyanamide and one-third nitrate of soda (with seed). A basal dressing of 4 cwt. superphosphate and 2 cwt. sulphate of potash per acre was applied over the whole area. A plot at one corner was discarded because, being too near the road, it

suffered from trampling during the growing season, and a very poor plant ensued. A value for this plot was, however, calculated from the other twenty-four, and the experiment was twice as accurate as if the poor plot had had to be retained. The sugar beet results are :—

Average yield	No Nitrgn.	Sulph. Amm.	Mur. Amm.	Cyana- mide alone	General +Nit. Sod.	Mean	Stand. error
Tons pr. acre	6.1	7.4	7.3	6.8	7.5	7.0	0.26
Per cent. . .	86.1	105.5	103.7	96.7	107.4	100.0	3.74

There was a significant response to the nitrogenous manures in all cases except where cyanamide was the sole form of nitrogen supplied. This treatment was significantly below the mean of the others.

Conclusions.—Our experience of the past three years has shown that the newer types of experiment can be used successfully on non-experimental farms. All who have endeavoured to assemble the results of fertilizer trials throughout the country will be aware of the difficulties involved in the correct assessment of fertilizer value as based on the results of the “demonstration” type of experiment, and the utility of experiments of the type just described is manifest. They have been criticized on the ground (a) that they involve a large number of plots, (b) that the plots are too small to give significant results, (c) that they are difficult to demonstrate, and (d) that the results are difficult to interpret. When it is considered, however, that many questions can be answered from a single experiment, if sufficiently precise, the suggested arrangement may even prove to be an economy over existing methods. The average size of plot used (about $\frac{1}{4}$ acre for cereal and root crops) has been justified by work done at Rothamsted and Woburn, and by the results of the present study. The difficulty of demonstration is more than counter-balanced by the improved accuracy attainable by random arrangement, while the attempt to allow for soil variation is appreciated by the farmer when once the idea is put to him. Finally the interpretation of the results, while it involves a modicum of statistical knowledge in the preliminary working, is far more reliable than any results supposed to have been gleaned from experiments of the single plot type. The Statistical Department at Rothamsted is always ready to give advice on the lay-out and interpretation of field experiments.

We do not pretend to have attained perfection in the application of these methods to ordinary farm conditions in the short space of three years. Thus, in the case of cereal crops, difficulty has been experienced in harvesting and thrashing small plots without adequate apparatus, while the weather during the day or two when the work has to be done may be unpropitious. It is hoped, however, that the introduction of methods, now being developed at Rothamsted, of assessing the yield by reliable sampling methods, will obviate most of the difficulties hitherto encountered. The following table gives some idea of the time and labour involved in experiments other than cereal.

Crop	No. of plots	Size of plot	Time taken to set out and manure	Time taken to harvest and weigh	No. of persons required for weighing
Hay ..	16	$\frac{1}{4}$ acre	8 hours	1 day super- vising cut- ting. $1\frac{1}{2}$ days weighing (30 cwt. crop)	1 supervisor 2 labourers
Sugar beet or swedes ..	25	$\frac{1}{10}$ acre	8 hours	1 day super- vising lifting 1 day super- vising weighing	1 supervisor 2 labourers
Potatoes	16	$\frac{1}{32}$ acre	6 hours	1 day arranging divisions 1 day lifting and weighing	2 supervisors 6 pickers

WORMS AND WORM DISEASES OF POULTRY

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WORMS belonging to the *Nematode* or *Round Worm* group are characterized by their rounded bodies and more or less thread-like appearance. The two sexes are not found in the same individual worm but are separate, and the male and female may show considerable difference in general appearance. Among the round worms which occur in poultry those responsible for the greatest loss are the gape worm *Syngamus trachea*, the caecum worm *Heterakis gallinae*, the large round worm *Ascaridia galli*, the gizzard worm *Amidostomum nodulosum* and the crop worm *Capillaria annulata*.

The Gape-Worm.—This worm, *Syngamus trachea*, (Fig. 1) is also known as the "Red-worm" or the "Forked-worm," and is responsible for the disease known as Gapes, or in Welsh as "Clefyd-y-big," "Y big" or "Clefyd-y-gawl." The gape worm has been found not only in the fowl and turkey but also in the pheasant, partridge, peafowl, pigeon, sparrow, linnet, starling, magpie, jay, rook, thrush, martin, swift and green woodpecker. The worms are situated in the wind pipe, and occasionally in the smaller air passages, where they attach themselves to the walls. Their harmful effects are produced by sucking the blood of the chick and irritating the lining membrane of the wind pipe. If many worms are present the wind pipe may be blocked, the bird dying quickly from suffocation. Turkey poults and chickens up to four weeks old are the most susceptible, and among such birds the mortality may be very high.

Symptoms.—The symptoms of gapes do not appear before the chickens are ten days old, and rarely in birds over four weeks old. A curious cough or sneeze with a shake of the head is usually the first symptom; later, birds are seen to stretch the neck forward with their beaks open in an attempt to take in more air. As the condition advances the feathers become ruffled, the wings droop, the eyes are frequently half-closed and there is a general appearance of dejection and exhaustion. When such symptoms have appeared death usually follows, due to suffocation from obstruction either with the actual worms or with the mucous secretion which is poured out by the irritated lining of the wind pipe.

Description.—The gape worm is bright red in colour ; males measure up to one-fifth of an inch in length and females up to one inch. The two sexes are invariably found together, the male being permanently attached to the female about a quarter of an inch from the head end. They are provided with a strong, horny, circular mouth, by which a firm attachment is made to the membrane of the wind pipe.

The mature female contains large numbers of eggs, small groups of which are frequently passed into the wind pipe. Where many gape worms are present in one bird, they are usually found crowded together in the lower half of the wind pipe.

Life History.—The eggs which are passed by the worm find their way from the wind pipe into the bird's mouth and are swallowed, finally reaching the ground with the droppings.

After a certain time on the ground, a minute worm develops within the egg, but a minimum period of nine days is necessary before it can be ready to infect another chicken. The rate of development depends upon weather conditions, and a longer period than nine days is usually required. Some of the eggs hatch, and the larva (minute young worm) lives a free life outside until picked up by a chicken. Others do not hatch, the larva remaining coiled inside until the egg is swallowed. Eggs are also disseminated in the saliva of the chick through violent coughing, during which intact worms may be dislodged from their position in the wind pipe and reach the ground full of eggs, many of which may develop. While lying on the ground the eggs may be swallowed by earthworms without suffering any loss of vitality, and chicks may be infected by eating earthworms containing ripe eggs.

On being swallowed the young parasites pass through the bowel wall and are carried by the blood stream to the lungs, where they become coupled. Nine days after the swallowing of the ripe eggs or infective larvae, the young worms reach the trachea, and eight to eleven days later the females begin to lay eggs. The quickest possible time for the completion of the life cycle is therefore 26 days. Chickens put on infected ground may begin to show signs of the disease in nine days, and to spread infection in 17 to 20 days. Adult fowls rarely harbour the worms and as a rule are resistant to experimental infection. If infection is successful, the few worms which attain sexual maturity are soon expelled. Adult turkeys, on the other hand, may be readily infected by feeding with ripe eggs and infective larvae, and it has been shown that under



FIG. 1.—The gapeworm,
Syngamus trachea.

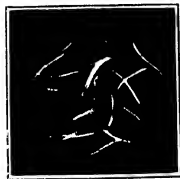


FIG. 2.—The caecum
worm, *Heterakis*
gallinae.



FIG. 4.—The gizzard
worm, *Anadolostomum*
nodulosum.



FIG. 5.—The crop
worm, *Capillaria*
annulata.

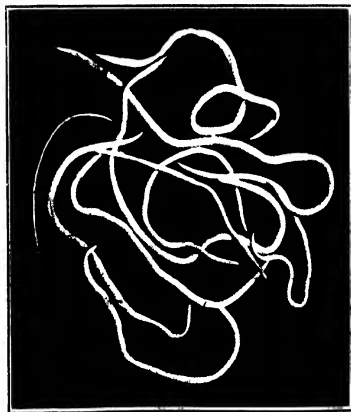


FIG. 3.—The large round worm,
Ascaridia galli.

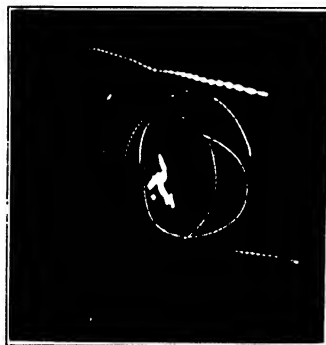


FIG. 6.—One of the large fowl
tapeworms, showing some of the
detached segments which may
frequently be seen in the faeces.



FIG. 7.—The smallest fowl tapeworm.
Segments become detached from this
worm at a very early stage, so that
the parent worm is very short and
never consists of more than three or
four segments.

WORMS AND WORM DISEASES OF POULTRY.

N.B.—The figures show the worms in their natural sizes.

natural conditions they frequently carry gape worms. An examination of 635 adult fowls at Washington, D.C., showed none to be infected with gape worms, while, of 679 adult turkeys examined at the same time, 22.5 per cent. were found to be harbouring these parasites. Infected adult turkeys usually show no symptoms of disease and may be unsuspected carriers of infection, acting as a reservoir and carrying the disease over from one breeding season to the next. The eggs of the gape worm have, however, great vitality, and may survive in the soil for a period approaching twelve months, while a few may live even longer. It is probable that wild birds play some little part in disseminating the infection; but the gradual and increasing contamination of a plot of ground with the eggs and larvae of the gape worm is the important factor in the final production of a disastrous outbreak. If a few infected chickens are allowed to remain in the pen during the first season, the eggs they disseminate will infect more chickens the next year. Although the outbreak may not yet be of such a nature as to cause alarm, if the now greater number of affected birds are still allowed to contaminate the ground it is likely that in the third year many chickens will die, and in time the rearing of chickens on that ground may be almost impossible.

Prevention.—(1) Incubator-hatched chicks should be transferred to the brooder on a patch of ground reserved solely for this purpose, and should not be removed to the other pens until they are at least six, or preferably eight, weeks old. Older birds should never be placed in this pen either during or between the breeding seasons, as they may be introducing infection. For the same reason any chicks which escape from the brooder pen should not be allowed to re-enter it. As soon as the breeding season is over this pen should be treated with a heavy dressing of ground quicklime, so that the ground is covered and nothing can altogether escape its action.

An alternative method is to spray the ground with a 1 per cent. solution of commercial sulphuric acid.

After the dressing has had time to act properly on the surface, it may be dug in with a spade: but the most important point in this system for the control of gapes and other infectious diseases of chicks is to allow no adult fowls to gain access to the brooder pen at any time throughout the whole year.

(2) Where a pen has become infected and clean ground cannot be found for chick rearing, a layer of cinders 4 to 6

or more inches deep, should be placed on the ground over the whole area of the pen. This will raise the chicks above the infected ground, and is better than a similar layer of clean earth, in that earthworms, which may carry the infection, will not find their way so readily to the surface.

(3) All chickens should be very carefully watched, and any suspected of the disease should be immediately removed, as they may be scattering hundreds or thousands of eggs daily.

The worms can frequently be seen in the wind pipe, by holding the chicken so that the sun, or a bright artificial light, shines on to the front of the outstretched neck, and looking down the throat. Sometimes, however, the worms are too deeply situated to be seen in this way.

(4) Turkeys and chickens should never be kept together, as adult turkeys frequently carry infection.

(5) Chickens should never be reared on ground where an outbreak has occurred during the previous season, as the gape-worm eggs can survive through the winter.

Treatment.—There is no satisfactory treatment for infected birds. Sodium salicylate at the rate of 3 drams to every quart of drinking water may be tried on those which have already been isolated.

Fumigation with such substances as heated carbolic oil, tobacco smoke and burning sulphur, or with fine powders, are of little value; while efforts at mechanical removal with horsehair loops or feathers, or local applications to the parasites are likewise of little or no use, and often dangerous. The safest and most economical procedure is to kill affected chickens on the first appearance of disease, and to burn the carcasses.

Intestinal Round Worms.—The presence of round worms in the intestine is not a very common cause of death among domestic birds, but outbreaks in chickens associated with heavy loss have occasionally been reported. Although these worms do not frequently cause death, there is little doubt that they are often responsible for unthriftiness, and for predisposing the birds to the attack of other diseases. In this manner they contribute to the general losses, more especially among young birds.

The two commonest round worms of the intestine of the fowl are the Caecum Worm (*Heterakis gallinae*) found in the blind gut (caecum); and the Large Round Worm (*Ascaridia galli*), found in the small intestine.

The Caecum Worm (Fig. 2) occurs in about 80 per cent. of fowls in this country, and may be looked on as a normal

inhabitant of the blind gut, only causing appreciable harm when present in large numbers. It is also a parasite of turkeys, and has an interesting connexion with the disease popularly known as blackhead (scientifically as *Infectious Entero Hepatitis*). It has been shown that this disease frequently occurs in fowls without causing noticeable symptoms, and that the caecum worm is capable of carrying it from fowls to turkeys. This is a second reason for keeping these birds separate; their cohabitation encourages gapes in chickens and blackhead in turkeys.

The Round Worm (Fig. 3) occurs in about 20 per cent. of fowls in this country, and if present in large numbers may do considerable harm, particularly to young birds. A deficient diet has been experimentally shown to lower the resistance of chicks to this parasite, and green food should never be altogether absent from a diet. This worm does harm by injury and irritation to the membrane lining the intestine, by actual blockage of the intestine when large numbers are present, and by the production of a poison which makes the chickens bloodless and weak. Death may occasionally result.

Life History of the Caecum Worm and the Large Round Worm.

—The adult worms in the bird's intestine lay large numbers of eggs which pass out with the droppings. On the ground, under suitably warm conditions, minute worms develop within the eggs. Under the most favourable conditions, however, the eggs of the large round worm cannot infect a fowl until they have been on the ground for seven days, and a period of eight weeks is necessary for the eggs of the caecum worm to become infective.

Control.—The system of managing incubator-hatched chicks advocated at p. 535 for the control of the gape worm is valuable as a means of checking these worms also.

Where birds have become very badly infested, and it is not possible to move to fresh ground, the whole of the surface soil of the pen, to a depth of several inches, may be removed and taken to a place where the birds cannot get to it.

Wherever possible, an occasional move to fresh ground is of great assistance.

The eggs of these worms are very resistant and can persist alive for a long period, the extent of which has not been accurately determined. Although the majority of eggs will persist in a patch of ground, kept entirely free from poultry for a period of 12 months, some will retain their vitality even longer.

Treatment.—The following use of tobacco and tobacco extracts is recommended :—

(1) For 100 birds, 1 lb. of finely chopped tobacco should be steeped for two hours in sufficient water to cover it, and the whole should be mixed with half the usual ration of mash. All food should be withheld on the day previous to treatment, and on the following day the mash and tobacco should be offered. Two hours after the birds have eaten this they should be offered one-quarter the usual mash ration made with water in which Epsom salts has been dissolved at the rate of 11 oz. for every 100 birds. The treatment should be repeated in 10 days' time.

(2) The following individual treatment gives better results. A stock mixture consisting of 6.6 cubic centimetres of 40 per cent. nicotine sulphate and 16 grammes of fuller's earth should be prepared and administered to fowls in small gelatine capsules in doses of 0.5 gramme.

(3) Another method of mass treatment is to administer oil of chenopodium mixed with a moist mash at the rate of one teaspoonful of the oil for every 12 birds. The above medicines are poisonous and it is advisable to dose a few birds before undertaking the wholesale treatment of the flock in order to be sure that the dose is correct.

The Gizzard Worm of Geese.—This worm, *Amidostomum nodulosum* (Fig. 4), is occasionally responsible for heavy loss among geese in the British Isles. The symptoms are those of general debility, leading to great weakness. Old geese have a certain amount of resistance, but where a bad outbreak occurs young birds may die in three to eight days from the first appearance of symptoms. The gizzard of affected birds will be found to display brown crusty patches on the inner lining.

Description.—The worms are white or yellowish-white in colour, measuring from one-half to one inch in length and as fine as a piece of cotton thread. They bury their heads in the gizzard wall, and if an affected organ is opened and washed in water, their tails may be seen protruding between the dark crusts.

Control.—The life history of this parasite is unknown, but it is probably similar to that of the large round worm and the caecum worm. Control measures must depend upon the safeguarding of goslings by keeping them completely apart from old birds, which might be carriers of the disease. The worst outbreaks occur on damp land, so that this should be

avoided wherever possible. No treatment of any value is known.

The Crop Worm of Fowls and Turkeys.—This parasite *Capillaria annulata* (Fig. 5), sometimes causes loss by interference with the normal working of the gullet and crop, in the lining membrane of which it is found. The membrane becomes thickened, owing to a deposit on its surface, and loses its elasticity. Affected birds refuse food as the condition advances, and before death the act of swallowing may become impossible.

A similar condition is caused in the duck by another species, *Capillaria contorta*. As with other worms mentioned above, young birds are more susceptible than adults.

A similar species, *Capillaria retusa*, occurs in the intestine of fowls, and occasionally causes disease and death if present in large numbers. Affected birds become very thin and bloodless, and on post-mortem examination a greyish yellow exudate may be seen lining the intestinal walls, which are thickened and show reddened spots and streaks.

Description.—These worms are from three-quarters of an inch to an inch and a-half in length, and are so fine and hair-like as to be difficult to recognize in their natural position in the bird. They may best be found by scraping the affected part with a knife or needle point, and examining the scraped off portion in water on a dark background.

Life History.—Little is known, but in all probability it resembles that of the caecum worm of poultry.

Control.—The plan advised at p. 535 in connexion with gape worms should be followed; and the tobacco treatment as for the intestinal round worms (opposite page) may be tried.

Tapeworms in Poultry.—These worms (Figs. 6 and 7) are flat and ribbon-like, composed of a number of joints or segments. They are fixed on to the wall of the intestine by a very small head, which is usually armed with hooks and suckers for that purpose. Several kinds of tapeworm occur in domestic birds; some measure as much as 10 in. in length, while others are so small as to escape notice unless looked for very carefully. One species causes, in the intestinal wall, nodules which might be mistaken for those caused by tuberculosis. Poultry may carry a few tapeworms without detriment to their health, but if the worms are numerous loss of condition will result and birds may die. Turkeys and geese are most susceptible to the harmful effects of tapeworm infection, but

fowls may also occasionally suffer. Ducks, on the other hand, are rarely affected, and may harbour many worms without apparent harm. The symptoms associated with tapeworm infestation are as follows: Diarrhoea, the excrement being sometimes streaked with blood; the appetite may remain good at the outset, but it gradually disappears, and the birds become thinner and show extreme dejection and weakness before death; partial paralysis or convulsions may be shown in the later stages of the condition. Examination of a bird which has died as a result of parasitism by tapeworms will reveal their presence in more or less large numbers in the intestine, the wall of which is usually thickened and shows small red spots on its inner lining. If the intestine is slit open and placed in water, the worms may be more readily seen as separate from the normal contents. In life the presence of tapeworms can be detected by the frequent appearance of whole worms or segments of worms in the droppings, the discovery of which may also be aided by the examination of the faeces in water.

Life History.—The cycle of development of the tapeworms of poultry is complex. The eggs, either separately or contained in the ripe segments, reach the exterior in large numbers with the droppings. These are not capable of infecting another fowl until an intermediate stage has been passed in the body of some small creature; some tapeworms require the intervention of slugs or snails, some earthworms, and others flies. It is only by eating one of these creatures which contains the intermediate stage of the worm that poultry can become infected.

Control.—In part, this must be directed toward control of the small creatures which harbour the intermediate stage. Flies breed in heaps of decaying manure, so that care should be taken to remove all such from the vicinity of the poultry runs. Any collection of manure which cannot be conveniently cleared away should be sprayed daily with some disinfectant solution. Slugs and snails are likely to be found in large numbers on ground near woods and hedgerows; such places should therefore be avoided when possible. Large stones and bricks form suitable hiding places for slugs and snails, and should be cleared off the runs. Incubator-hatched chicks should be reared for the first six weeks on clean ground situated at some distance from the other pens, and the system for the rearing of chicks advocated at p. 535 for the control of gape worms should be applied.

Treatment.—Good results have been claimed for a drug called Kamala, a brown powder which is given in doses of one gramme for mature fowls and two grammes for turkeys. The best method of administration is in the form of a pill or a capsule. The treatment of a whole flock by admixture with the food is less effective. No previous fasting or subsequent administration of a purgative is necessary. As an overdose might do more harm than good, Kamala being a poisonous substance, it is wise to dose a few birds before undertaking the wholesale treatment of the flock, in order to make sure that the proposed dose is not too severe.

Powdered pomegranate root bark has been used with success and is given, suitably diluted with meal or mash, at the rate of one teaspoonful to every 50 birds. It should be followed by a purgative dose of two-thirds of a teaspoonful of castor oil per bird, or dissolved Epsom salts mixed with the mash at the rate of 11oz. per 100 birds.

Turpentine is the best of the common remedies and can be given as follows: food should be withheld in the morning and Epsom salts, mixed with a little mash, given in the evening. One teaspoonful of the salts, dissolved in warm water before mixing it with the mash, should be allowed for each bird. On the following morning, turpentine should be administered in a dose of one to two teaspoonfuls per bird, mixed with an equal quantity of olive oil. This can be poured into the mouth, or put directly into the crop through a rubber tube passed down the throat and gullet, or by means of a medicine dropper. It is useless to mix turpentine with the food as the birds will not eat it because of its offensive taste. Three or four hours after the dose has been administered, another laxative mixture of mash and Epsom salts should be administered as before.

* * * * *

MANAGEMENT OF FARM HEDGES—I

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General.—Judging by the way in which many hedges are treated, or more often neglected, one is led to believe that the importance of this branch of farm husbandry is not well understood in many parts of the country. Comparatively few young men take up the work, and it is a difficult matter in many districts to find men who know how to treat a hedge in the most economical and satisfactory manner.

It is very desirable that the hedger should understand what is the best treatment to suit varying conditions, because methods that may be correct for one hedge may be unsuitable for another. Treatment is governed to a great extent by the age and condition of the hedge, its position, and the purpose for which it is intended.

An old, over-grown hedge with a thin bottom and many gaps, requires “laying” or “layering” (known as plashing and pleaching in certain districts) to make it an impenetrable barrier, stock-proof. Younger hedges that make little growth at the base may also be improved by “plashing.” Hedges that have been trimmed or twigged for a number of years, and have become full of holes in the bottom, may also receive the same treatment with advantage. Those that are overgrown, thick at the base, and still stock-proof, may be allowed to remain in their present state a few years, especially if required for shade and shelter in grazing districts; or it may be advisable to “scotch” them if shade is not required. This, it must be remembered, can only be carried out with success in the case of hedges that have a good bottom and will be stock-proof when the top and part of the sides are removed. Hedges that have been thus treated or “plashed” may be trimmed, twigged or brushed for a number of years, especially if situated on arable land or near the roadside.

The height to which a hedge should be cut depends upon its position and the purpose it is intended to serve. Arable land hedges that are subject to stock only at times when seeds or roots are “eaten on” need not be more than 3 ft. high. It is important, however, that grassland hedges should be at least 4 ft. 6 in. high, strong and of fair thickness, to ensure a barrier against all kinds of stock.

Shelter from the cold winds in winter, and shade in summer, is of importance in grazing districts, and hence the whole of

the hedges should not be lowered at the same time. Those that have gaps in the bottom and require fencing to make them stock-proof should be cut first. Others that are in a better condition may be left to give shade and shelter until those that are already cut thicken and grow up. This takes from 6 to 10 years, although much depends on the type of soil, the protection and attention that have been given. Hedges make much better progress on heavy soils than on sandy ones. On the latter type of soil, hawthorn is subject to canker, caused by the cutting nature of the blown sand, and through being gnawed by rabbits. It is advisable to rid the hedgerows of these pests, care being taken to fill in their burrows, to prevent air from drying out the fibres of the roots.

Burnt hedges (very common near railways and highways during very dry periods) should be chopped off at the base immediately after the damage is done. It will be found that as the sap rises, new growth will shoot, and if protected, will produce a new hedge, which can be "plashed" or "scotched" as desired when sufficient growth is made to ensure the work being satisfactory.

Grubbing up is the most economical way of dealing with arable land hedges that are so full of gaps that they could not be made up by plashing. Thus, turning the existing fields into larger areas may be found advantageous, and save a great deal of time now that modern machinery is used so extensively on the farm; larger teams can be worked, and much time saved by longer rounds and fewer turnings. The farm tractor is a useful machine for this work; by digging part of the soil from the roots, it is a simple matter to haul out quite large stumps by the aid of strong cables or logging chains. Before starting to grub up hedges on a rented holding, it will be advisable first to get the written permission of the landlord.

When gaps are being stopped in hedges that are getting worn out at the base, it is advisable to refrain from nailing the material used to the growths in the hedge, because the nails are a great source of trouble to the hedger when at work with good tools at the plashing. The rails or runners used should be pushed into the centre of the fence and fastened by nailing to pales or stakes which are driven firmly into the ground.

It is a bad policy to cut off branches from the hedge to push into existing gaps. The absence of these branches may result in gaps that cannot be made up at the time of plashing

If it is desirable to stop gaps by the method of using brushwood for a short period until the plashing can be carried out, a few briars may be used, and thus prevent cutting out growth that will be required for layers.

With reference to the general management of hedges, a little attention may be given to cleanliness ; although in these times one can hardly be expected to spend much time and labour in digging out hedgerows, it is important to rid the hedges of such weeds or plants as the elder, briar, bramble, bryony, bittersweet or woody nightshade, and wild hop. Many hedges are ruined by allowing these to exist. It is work that can be done by inexperienced labour during slack times in winter, and will assist in the improvement of the hedges generally.

Layering or Plashing Hedges.—It is sometimes necessary to make preparations for this work by providing stakes and binders before the actual plashing can be done. On some hedges there is an abundance of growth and sufficient stakes and binders can be cut out at the time of plashing to maintain the fence. Many different kinds of wood can be used as hedge stakes, but the most suitable are obtained from the underwood of plantations or by lopping willow heads. Ash, oak, elm, hazel, fir and hawthorn provide suitable material for stakes. When purchasing or cutting stakes it is necessary to ensure that they are long enough to allow for pointing, and to be driven into the ground firmly, and still leave sufficient length to keep the hedge the desired height. Stakes made of willow should be peeled at the base—the portion driven into the ground—to prevent them from growing. Riven or split stakes can be made from oak, ash and willow if the material is too large when used whole. All stakes should be pointed at the thick end, care being taken to straighten the drive of any that are crooked. Live stakes are sometimes left in the hedge ; these are quite useful providing they are not left too often. One every five yards will strengthen a grassland hedge considerably. It is important, however, that they should be chosen from young growth and cut at the base to promote growth. If possible, they should be left on a stump from which layers have been taken ; this will ensure new growth at the base.

Briars, ash, elm, willow and hazel provide excellent material for binders. They should be at least eight feet long, and pliable, to allow for twisting and interlacing the stakes. In districts where binders cannot be obtained, sawn bannisters are



FIG. 1. Type of hedge that requires laying or "plashing."



FIG. 2. Type of trimmed hedge that requires plashing after a few years' growth.



FIG. 3. --An Elder hauled out by tractor.



FIG. 4. Brushing or trimming.



FIG. 5 (left). New growths on old to be used in the new hedge.



FIG. 7 (right). Unsuitable unless protected in grass fields. Only suitable where stumps are plentiful.



FIG. 8 (left). A well protected roadside hedge.



FIG. 6 (right). Willow-stakes should be peeled at base to prevent growth.



FIG. 9 (left).— Old layers that have taken root through being buried.

FIG. 10 (right).— Suitable tools for layering or “plashing.”

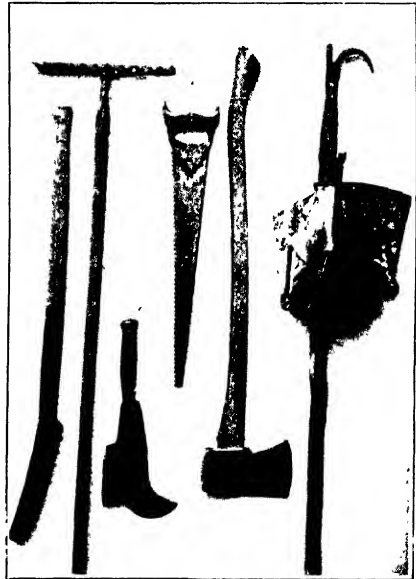


FIG. 11 (below).— A grass-land hedge: brush equally divided.





FIG. 12 (left).- Roadside plashing where protection is given against hares and rabbits.



FIG. 13 (right).- A strong effective barrier against all kinds of stock.



FIG. 14 (left). Method of shortening a stem for filling a gap

FIG. 15 (right). Layers placed off stumps. A well-bound hedge.

sometimes used. They are long strips of wood, usually deal, of various lengths, 2 in. by 1 in., and are nailed to the top of the stakes. These can be purchased from most timber merchants or sawn out on the farm, where the necessary machinery and material are available. Thin wire is sometimes used for the purpose, but it is not so satisfactory as either binders or bannisters, is dangerous in hunting districts, and is not recommended.

The best time of the year for plashin is in the early spring, especially on old, overgrown, cankered hedges, because as the sap rises the branches and growths are most pliable. It is, however, quite possible to plash any time between October and May. The younger hedges can be done in winter, and the older ones in spring. The work should be discontinued when the bark breaks at the back of the layer, because then the sap cannot rise and the layer cannot live.

The most suitable tools consist of a strong slasher, axe of 4 lb. in weight (fitted with a handle 2 ft. 9 in. long), handbill, pair of mittens, spade, rake, hook and whetstones. The mittens should be made of whit leather, the left hand of strength to prevent thorns from entering, and the right soft enough to enable one to grasp the tools. The hook should be similar to a boat-hook, and is used to pull down tall branches intended for layers. It is important that the tools used for cutting should be made perfectly sharp first by use of the grindstone, then whetted to a smooth finished edge by the use of the smooth oilstone or fine carborundum. This will ensure a clean cut and greatly assist the worker to do good work. The handles of the tools should be made of hickory or ash that has a straight grain running the whole length of the wood. Cross-grained shafts are easily broken and are unsuitable. The handles can be improved and preserved by polishing with emery paper and giving a few applications of linseed oil.

Before commencing to plash a hedge it is important to decide which will be the best way to lay, the most suitable end to start, and the type of hedge that should be made. If there are sufficient new shoots growing from the stumps at the base of the hedge to ensure a satisfactory job, it can be layered either way or started at either end as convenient ; but if it is necessary to utilize new growths from the old layers in order to make a hedge of the desired height and strength, it will be advisable to lay in the same direction as before. The old layers can be lowered by repleaching them, and the younger

growths laid from them. Old layers that have been lowered will sometimes take root if cut and partly buried. This is useful on hedges where there is a scarcity of stumps and vacant spaces between them. On hillside hedges, it is advisable to begin at the highest point, lay up-hill, and work down towards the bottom. This gives the layers a better chance to draw the sap, and they live longer than would be the case if layered down-hill. It is best to work on the roadside, ditch-side or arable side of a hedge if possible, the advantage being that it is possible to cut away growths in order to get close in to the hedge, without taking away material that will be required for the finished hedge. All branches may be used up to make the hedge from the offside; this gives good protection, and prevents stock from reaching over to the new growth. When working on the ditch side, it may be necessary to use planks placed upon strong pieces of wood, resting across the ditch, and moved as the work is completed.

Hedges between arable and grass lands should be layered with the majority of the branches to the grass side, and only a small quantity on the arable side, to protect the new growth from sheep, hares or rabbits. There should be sufficient brush on the grass side to protect the hedge from damage by all kinds of stock. On hedges between two grazing fields where there is not a ditch, it will be advisable to divide the brush or branches equally on each side, thus ensuring protection on both sides. One disadvantage with this method is that the new growth makes slower progress, but it must be remembered that slow growth is better than quicker, unprotected growth that is quickly eaten off by stock. If a hedge between two grass fields has a ditch at one side, it may be layered with one clean side on the ditch side. It will make a good growth, but this method is useless unless the hedge is protected—usually done by cleaning out the ditch and placing the thorns in it, or by the use of back fencing of posts and a top rail or wire. If wire is used a notice-board should be erected.

The Operation of Plashing or Layering.—In carrying out the actual process of plashing, it is important that dead wood, decayed stumps, leaves and other rubbish should be removed from the base of the hedge, in order that air can move freely round the stumps, and also to allow the cutting to be done as low down as possible. It is necessary to have a small opening or gap when commencing, to enable the hedger to get at the work and to provide a space in which to place the layers.

The size of this gap depends upon the length or height of the growths that are to be layered. It may be much larger for long, tall branches than where shorter growths exist. Short growths are usually fitted into the bottom of the hedge, those of medium length into the middle, and the taller growths are used to build and level the top. They are held in position by interlacing them round the stakes which are driven firmly into the ground. The placing of the stakes rules to some extent the position of the layers. If they are driven in line with the stumps in the centre of the hedge, the layers will rest over the stumps, and the new growth will grow through them, thus holding the hedge together when the stakes have decayed. This type of hedge will make a very effective barrier against all kinds of stock, as the layers protect the new growth in some degree.

If it is intended to place the layers off the stumps, a custom carried out in some counties, the stakes are placed at the side (usually the offside) of the stumps. In this case the new shoots do not grow through the layers, but make excellent progress owing to the protection afforded. It is a style of work that does well on hedges that have an abundance of growth and stumps at the base. It is not suitable for hedges that have a scarcity of stumps and some distance between them.

There are a few items dealing with the nature of the hawthorn and the result of cutting that should be understood before one proceeds far with the actual layering of a hedge. It will be noticed that when a portion of a plant is cut, new growth will quickly follow. The explanation is that if the plant is not cut or broken, it will simply grow longer and stronger each year, and all buds, except leaf buds near the outside of the plant, will lie dormant. If, however, a portion is cut off, the sap is allowed to escape, and the buds below the cut put out new wood growth. These dormant buds are to be found at intervals down the whole of the stem. They are not easy to discern near the base, owing to the gnarled appearance of the bark, but it must be remembered that they exist, and it is important when plashing that the cutting should be done at the base in order to promote growth from the bottom of the hedge. The whole of the cutting should be done in such manner as will leave a clean face on the work. This is secured by cutting in the same direction that the stem is growing or leaning (usually an upward stroke). On examination, it will be found that one side of the cutting tool

used leaves a clean cut, and the other side makes a rough jagged or broken face. This should be on the portion that is thrown out as waste. The smooth face on the stumps will prevent water and weather from causing decay, especially if a clean slanting cut is made.

When the actual plashing of a growth is being done, it is advisable first to free it at the top from the remainder of the hedge by pulling it in the direction of the gap. It is sometimes necessary to cut out branches with the slasher before this is done, but care must be taken not to cut away twigs and branches that will be required to make up the gap. The lower portion of the growth near the ground is the place where the pleach or split is made, by chopping with a downward stroke about two-thirds of the distance through, then causing it to split down to the ground or the place intended for the bend, by means of leverage with the tool used, the axe for heavy work, and the handbill for slender stems. It is important that the bark should not be damaged at the place where the layer is turned over, because this is the only source for the sap to rise. The portion of the pleach left standing on the stump is known as the "lip." This should be cut off with a slanting upward cut, or new growth might grow at the top, which would be a very poor foundation for the future hedge,

If exceptionally heavy and thick growths are to be layered, it is an excellent policy to cut away a portion from the front near the base of the hedge before making the downward stroke. This will assist by causing the chips to break away, and prevent the wedging of the axe. Another advantage is that the lip is cut off before the layer is weakened, doing away with the risk of jarring off the layer, as will be the case if a strong lip is left to be cut afterwards.

It is advisable to pleach strong layers so that the bend is made on a flat surface near the ground. This is done by making the cut on the opposite side of the stem at the front or on either side, using discretion as to what position is most suitable. If pleached at either side, great care is required in turning the layer round to the line of the hedge. Brittle or cankered stems can often be laid on a root, which is more pliable than any part of the stem. It is important, however, when doing this, to leave a portion of the stump above the ground to ensure new growth. Side roots are often available for this purpose and give every chance of successful layering. On hedges that are composed of very uneven growth, it is important to prepare for filling in of weak portions of the hedge, by leaving growths,

when plentiful, to lay in either direction. Stems growing from the sides of the hedge are most suitable for this purpose. It is often necessary to shorten a growth in order to fill in a gap. This is done when it is noticed that the growths in front will not reach far enough to fill in the gap. It is accomplished by making two pleaches, the lower near the ground made at the back to allow of the layer being pushed forward, and the second and upper pleach at the front in the usual way about two feet high. Both pleaches are made before laying. The lower part of the stem is taken away from the gap, and the upper turned back into the gap. This method will bring the work up enough for the layers in front to fill in the gap, and thus save the expense of making up with sawn fencing.

After a portion of the hedge has been well layered, and staked, the binders or bannisters are worked on in the following manner. The thick end of a binder is pushed in at the back of the first stake, taken in front of the second stake, then to the back of the third. The second binder, which should match the first as near as possible, is placed at the back of the second stake, in front of the third, and the binders are twisted together to ensure being firmly fastened. Other binders are placed in the same way along the hedge, and each pair should overlap the thin ends of those already placed, to ensure a firm and level finish. The tops of the stakes will require levelling to give a well-finished appearance. This can be done by the use of the saw, or cutting off with the handbill. If done with the latter, the stakes are held firmly by placing a heavy stake at the back of the one to be cut; this will hold it firmly in position while the top is cut off with an upward cut of the handbill.

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AN INVESTIGATION OF ENGLISH WALNUTS

H. V. TAYLOR, O.B.E., A.R.C.Sc., B.Sc.,

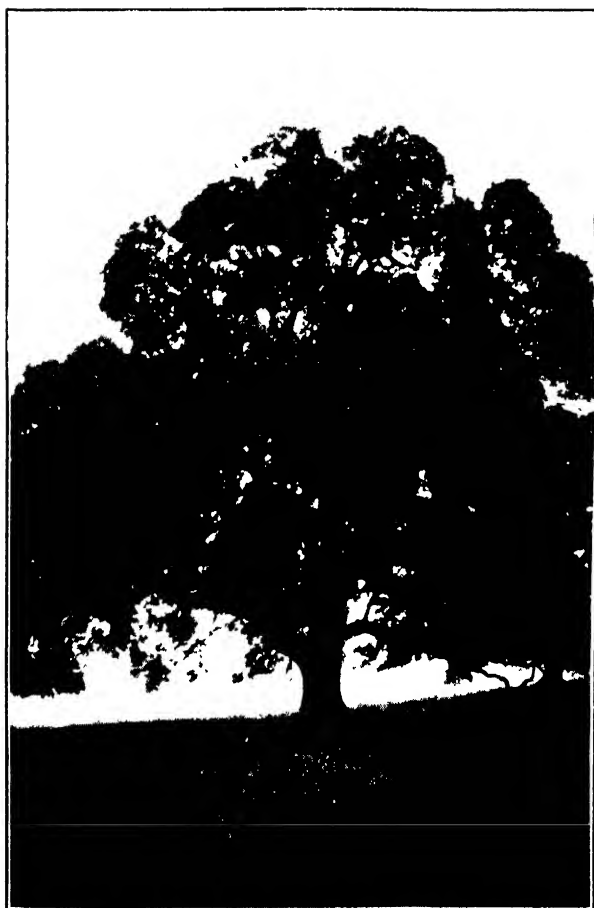
Horticultural Commissioner, Ministry of Agriculture and Fisheries.

IN the *Journal of Pomology and Horticultural Science* (Vol. IV, No. 1, July, 1924) appeared an account, by Howard Spence, of the production of walnuts in the Northern United States. It is necessary to remind readers that the walnut trees planted when that industry was first started were those raised as seedlings from planted nuts. This method of propagation has since been superseded, and present plantings for commercial purposes are confined to trees that have been raised by budding or grafting scions taken from a tree of proved quality. It is largely from these plantations of grafted trees that come the very large supplies of walnuts—43,000 tons in 1927—which have made California an important walnut-producing country. Although the best walnuts in France and Italy are produced from grafted trees, in the continents of Europe and Asia walnut trees in the main are raised by sowing nuts—either those of good appearance or those taken from trees that have a good record—so that each raised tree is a new seedling on its own roots. In common with many fruit trees, the walnut cannot be relied upon to breed true to variety, and in some characters the seedling trees exhibit variations, though it often happens that there is a certain family relation to be seen in many respects.

This variation of character is unfortunate, for though a really good variety may have been discovered and grown by this method of propagation, there is no propagation of the exact variety but a continuous production of new varieties many of which are of poor type.

The good characters of the original parent are not lost, but become spread out amongst its progeny, in which one may retain size, another flavour and a third quality and show other latent evidences of varied ancestry.

In an article giving the results of an inquiry into the quality of English-grown walnuts (*Jour. Pom. and Hort. Sci.*, Vol. V, p. 223) Spence defines the quality of walnuts for commercial purposes by the following characters:—Size, Colour, Contour, Thickness of Shell, Sealing, Percentage of Kernel, Astringency and Flavour. Thus a good dry walnut should be of a size weighing from about $\frac{1}{3}$ to $\frac{1}{2}$ oz., of light



One of the best English Walnut trees, 200 years old,
located in Worcestershire.

yellowish-brown appearance, moderately smooth, regular, not deeply pitted, and reasonably stout, well-sealed shell. The kernel should average from 45 to 50 per cent. by weight of the dried nut ; and in the unpeeled state be not astringent. The flavour should be mild, sweet (not sugary) and essentially nutty. Walnuts of such a standard are very largely produced in California, and many parts of Persia, France and elsewhere, and some may exist in England.

From 1924 onward, an endeavour has been made each year to locate trees in England that are producing nuts of this quality. At the same time imported walnut stocks have been planted at East Malling so that the material should be available for grafting as soon as the best trees have been located.

The poor weather conditions of 1924 were evidently unkind to this fruit, which is a lover of sunshine, for all the nuts sent in during that year were described as of poor quality and none could be considered good enough for propagation purposes. The season of 1925 was generally more favourable, and in consequence the nuts analysed out better—in fact a few trees were found that produced nuts of more than average merit ; yet none of these quite reached the desired commercial standard. All the good characters hitherto referred to have been found in English nuts taken collectively, but so far they have not all been found present in the same nut. Worcestershire, Surrey, Norfolk and one or two other counties have yielded promising walnuts. One of the best trees located was in Worcestershire. This was a pure 200-year-old tree which has an annual average yield of 8 cwt. and has been known to yield 15 cwt. The quality is very good.

The large nuts usually have inferior kernels, or contain far too high a percentage of moisture, whereas the better quality nuts have frequently lacked size. Walnut trees flowered well in 1926, but the crop was ruined by late frosts and high winds, and only in isolated cases did any considerable quantity of nuts mature. The results of the investigations in 1927 and 1928 were no more successful, for none of the nuts examined showed any special merit.

This year the Ministry has invited the Royal Horticultural Society to co-operate, and as a result the Society propose to hold a walnut Show on November 19. Full particulars of this show can be obtained from the Society. It is hoped that this activity will result in the bringing forward of nuts of a higher standard than has been discovered hitherto, for

undoubtedly in England there are at least some few walnut trees of real merit.

In the meantime activities in other directions are well forward. Nuts from the four corners of the earth have been collected and analysed, and in many instances scion wood, taken from extra good trees, has been obtained from France, California, Canada, Italy, Persia, North Africa, etc. Seedlings from some of the finest foreign walnuts have been planted and will be tested out. There is a risk (probably a real one) that many good varieties grown in foreign countries may prove quite unsuited for growing in this country. In such a case the research worker will be compelled to work largely with existing English nuts, and hence the need for discovering the best tree is all-important.

In the meantime, in addition to testing experimentally some half-dozen English and twenty to thirty foreign types, the East Malling Research Station has done some very valuable work on vegetative walnut propagation, and undertaken an investigation into the important question of stocks, so that some real progress may be recorded.

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THE ANGORA RABBIT WOOL INDUSTRY

BEFORE the War, the angora wool industry was of very small dimensions, confined for the most part to fanciers. A remarkable development occurred in the years just after the War, and though no reliable statistics exist as to the present extent of the industry, a census which was recently instituted by the Joint Angora Rabbit Wool Council indicates that the number of angora rabbits in the country is upwards of 120,000, distributed among some thousands of breeders.

Similarly, the value of the wool clip has shown an enormous expansion during the same period. For instance, the value of home-grown angora wool produced in 1922-23 has been estimated at only £290; a figure of £12,500 is quoted for 1926-27; and the estimated value of the crop in 1927-28 has risen again, to about £30,000. Figures which have been made public by one of the principal buyers of angora wool in this country, as to the values of the purchases of English angora wool made by that firm, give an indication of the value of the trade :—

				lb.		£
1922	..	..	..	30	..	35
1923	..	..	..	195	..	412
1924	..	..	..	604	..	1,086
1925	..	..	..	1,946	..	3,200
1926	..	..	..	5,860	..	8,970
1927	..	..	..	15,950	..	27,550

Taking the industry as a whole, it has been estimated that the amount of capital invested may be in the region of approximately £200,000 on the breeding and production side, and £120,000 in the spinning and manufacturing of the wool.

The price paid for first grade angora wool has remained steadily around 34s. a lb. for the last two or three years. A fully grown angora rabbit will yield generally about 10 oz. of wool a year. Feeding costs vary a good deal with circumstances, but with reasonable care should not exceed 10s. a year. With economical management, and in cases where comparatively little in the way of foodstuffs has to be purchased, feeding costs may be reduced to as low a figure as 6s. a year. Labour costs, however, in cases where labour has to be employed, will take a considerable toll from the gross profit since angoras need careful and skilful handling if first grade wool is to be obtained. Generally speaking, the price of 34s. a lb. for the raw wool which was realized at the beginning of last year was regarded as a very satisfactory price by the producer, and it is clear that the industry was at that time on the threshold of considerable expansion.

Imports, however, are of considerable size. Official statistics over a series of years are not available, but some indication of the extent of the imports may be gained from a statement by one firm that they import on an average 50,000 lb. of continental angora wool a year. Official returns show that in the period January to March, 1929, 211 cwt.—23,600 lb.—were imported.

In April, 1928, it was found that the market for the English angora wool clip was becoming very restricted, if not actually closing.

Among the reasons to which this closing of the market has been attributed, the following may be cited :—

- (a) Large imports of foreign, chiefly French, angora wool ;
- (b) the substitution of other material for angora wool in yarn and fabrics, with the result that public confidence in angora fabrics has been somewhat undermined ; and
- (c) changes of fashion which are said to have rendered unsaleable certain prominent lines of goods in the manufacture of which angora wool was a principal constituent.

The extent to which any of these factors was responsible for the present situation cannot be gauged with accuracy.

Angora fabrics and articles into which angora wool is introduced are apparently likely to be regarded as a luxury trade for some time to come. The market may, therefore, remain a somewhat special and restricted one, susceptible to changes of

fashion. The hope for the future seems to be to discover new uses to which angora wool may be put, and it is of interest to learn that in France there is a considerable demand for angora wool in connexion with the better class hosiery trade. In our own country, it is understood that an extensive series of experiments is in progress among manufacturers for testing out the suitability of Angora yarn of various counts and blends for making up into a larger range of garments than that for which it has hitherto been employed. From such indications as have already come to hand, the promoters of these experiments believe that angora fabrics will again come into public favour, especially if the use of long-staple yarn, which will get rid of the fluffy appearance hitherto associated with angora, comes into general practice. In any case, comparatively little development would seem to be possible while the industry is restricted in its application to children's underwear and to the provision of fancy trimmings for highly-priced goods. If so restricted, the industry would inevitably be liable to the vicissitudes of a business in which the demand is elastic and uncertain, but, on the other hand, it is doubtful how far prices could be lowered before the point is reached which would make the production of the wool unprofitable.

Although articles manufactured of pure angora wool are on the market, it is well known that for most commercial purposes some other material is admixed with the angora wool, either in spinning the yarn, or in the process of weaving. For the most part the composition of the yarn is a trade secret, but it is probable that considerable quantities of French angora wool, which is said to be of coarser texture than the English product, may be absorbed in this way, in order to give additional body to the yarn. This supposition is supported by the fact that French angora wool is imported at prices which are much lower than those paid for English wool.

French angora wool, which appears to be in competition with British produce on the English market, is not apparently on a much more satisfactory footing as an industry than is our own produce in this country. Great fluctuations in prices are reported and, as in England, no effective co-operation appears to exist between producers and spinners. So far as can be seen, however, the French industry is in a position to increase its production and exports at the sign of any favourable opportunity. In the three months ended March, 1929, imports of French angora wool into this country amounted to 18,900 lb., the

average value of which as declared to the Customs Authorities was approximately 14s. a lb.

At the time of writing (May, 1929) some of the chief English buyers are still restricting their purchases to comparatively small quantities from their old customers. Numbers of small rabbit keepers are consequently in considerable difficulties, and unless an outlet for the wool can be found in the near future the number of angora rabbits kept must soon show a serious decline. It is known that a number of rabbit keepers are spinning the wool for themselves, and others are making up the yarn into garments for local sale either by knitting or by means of small hand looms. While this is doubtless a useful expedient in tiding the individual over the present difficult period, it does not provide a solution for the industry as a whole. For this a better degree of co-operation between the breeders and manufacturers is necessary. In the meantime a development of some interest may be noted in the formation of an association of angora rabbit keepers in the Cotswold district under the title of the Cotswold Rabbit Breeders' Association. The Association functions as a co-operative society, taking its members' produce and arranging for its manufacture into yarn. Apparently there is no guarantee as to the price which the producer will receive for his wool, but the Association hope to pay about 35s. per lb., from which, however, a charge of 7s. 6d. a lb. is to be deducted for the expenses of spinning and administration. The Association is as yet only in its infancy, and it must be given time to demonstrate whether it is the kind of development which will enable rabbit keepers themselves to deal in some measure with the present situation. If the Association can develop its business on sound lines, it may lead to the better marketing of angora rabbit wool throughout the country, and open up the way for effective co-operation between producers and manufacturers. Work on somewhat similar lines is also being undertaken by the Somerset Rural Community Council, who are purchasing angora wool from producers in Somerset, and it is understood that the Council are finding a satisfactory market for the spun wool.

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1929

ACREAGE UNDER CROPS AND GRASS AND NUMBERS OF LIVE STOCK ON
HOLDINGS ABOVE ONE ACRE IN EXTENT IN ENGLAND AND WALES
AS RETURNED BY OCCUPIERS ON JUNE 4, 1929.

(The figures for 1929 are subject to revision.)

CROPS AND GRASS.

Distribution	1929	1928	Increase		Decrease	
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Per cent.</i>	<i>Acres</i>	<i>Per cent.</i>
TOTAL ACREAGE under all CROPS and GRASS ..	25,437,000	25,505,000	—	—	68,000	0·3
*ROUGH GRAZINGS ..	5,205,000	5,178,000	27,000	0·5	—	—
ARABLE LAND ..	9,948,000	10,109,000	—	—	161,000	1·6
PERMANENT GRASS :						
For Hay ..	4,695,000	4,500,000	195,000	4·3	—	—
Not for Hay	10,794,000	10,896,000	—	—	102,000	0·9
TOTAL ..	15,489,000	15,396,000	93,000	0·6	—	—
Wheat	1,330,000	1,396,000	—	—	66,000	4·7
Barley	1,122,000	1,185,000	—	—	63,000	5·3
Oats	1,852,000	1,763,000	89,000	5·0	—	—
Mixed Corn ..	140,700	119,300	21,400	17·9	—	—
Rye	34,700	30,500	4,200	13·8	—	—
Beans, harvested as corn ..	143,900	157,500	—	—	13,600	8·6
Beans, picked or cut green ..	12,900	12,500	400	3·2	—	—
Peas, harvested as corn ..	78,600	69,300	9,300	13·4	—	—
Peas, picked or cut green ..	53,800	44,700	9,100	20·4	—	—
Potatoes ..	518,900	489,000	29,900	6·1	—	—
Turnips & Swedes	699,100	722,300	—	—	23,200	3·2
Mangold ..	299,100	298,400	700	0·2	—	—
Sugar Beet ..	229,900	175,700	54,200	30·9	—	—
Cabbage for fodder, Kohl - rabi and Rape ..	124,800	124,900	—	—	100	0·1
Vetches or Tares	67,800	67,700	100	0·1	—	—
Lucerne ..	35,800	37,100	—	—	1,300	3·5
Mustard for seed	23,100	26,800	—	—	3,700	13·8
Cabbage for human consumption ..	32,400	27,900	4,500	16·1	—	—
Brussels Sprouts	26,700	30,400	—	—	3,700	12·2
Cauliflower or Broccoli ..	13,900	13,500	400	3·0	—	—

* Mountain, Heath, Moor, Down and other rough land used for grazing.

CROPS AND GRASS—*continued.*

Distribution	1929	1928	Increase		Decrease	
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Per cent.</i>	<i>Acres</i>	<i>Per cent.</i>
Carrots	10,300	10,000	300	3.0	—	—
Onions	2,400	1,700	700	41.2	—	—
Celery	5,700	5,800	—	—	100	1.7
Rhubarb	7,200	7,000	200	2.9	—	—
Linseed	3,200	2,600	600	23.1	—	—
Hops	23,900	23,800	100	0.4	—	—
Small Fruit ..	64,900	64,700	200	0.3	—	—
Orchards	248,200	248,400	—	—	200	0.1
CLOVER and ROTATION GRASSES:						
For hay	1,524,000	1,568,000	—	—	44,000	2.8
Not for hay ..	846,000	869,000	—	—	23,000	2.6
TOTAL	2,370,000	2,437,000	—	—	67,000	2.7
BARE FALLOW ..	325,200	468,100	—	—	142,900	30.5

The tabulation of the annual returns made as on June 4 by occupiers of agricultural holdings exceeding one acre in extent in England and Wales has revealed a further diminution in the area of agricultural land. The total area covered by the returns this year is 30,642,000 acres, or 41,000 acres less than in 1928. The area under crops and permanent grass is 25,437,000 acres, or 68,000 acres less than in the previous year, while the acreage returned as rough grazings at 5,205,000 acres shows an increase of 27,000 acres, which is little more than one half the increase shown in this class of land last year. The arable acreage has been further reduced to 9,948,000 acres, although the reduction, which amounts to 161,000 acres, is appreciably less than that shown in the two preceding years. The area under permanent grass is 15,489,000 acres, or 93,000 acres more than in 1928.

The changes in the distribution of agricultural land have thus followed generally on the lines which have become usual in recent years. It is, however, perhaps worthy of mention that, in spite of the decrease in the arable area, the acreage of land actually under crops this year—exclusive of clover and rotation grasses—was rather higher than in the previous year, the area returned as bare fallow being reduced by 142,900 acres or over 30 per cent. as compared with 1928, and being smaller in extent than in any year since 1915.

As regards crops other than clover and rotation grasses there is a net loss in the acreage under corn crops of about 19,000 acres, losses of 66,000 and 63,000 acres in the case of wheat and barley having been largely neutralized by increases in the areas of oats and mixed corn. The areas under potatoes and roots have increased by 30,000 acres and 32,000 acres respectively, but the increase in the latter is due entirely to a heavy addition to the acreage under sugar beet, fodder roots being grown on a decreased acreage. The acreage of most vegetable crops shows an increase, while the areas under hops, small fruit, and orchards show practically no change.

Cereals.—The acreage under wheat is 1,330,000 acres, or 66,000 acres less than in 1928. This reduction, amounting to 4.7 per cent., compares with a reduction of over 14 per cent. recorded in the previous

year. The decrease is fairly general throughout the country except in the Northern Division, which shows an increase of 14,600 acres or over 18 per cent. The Yorkshire wheat acreage is increased by over 17,000 acres, and there is an increase of 10,000 acres in the Lindsey Division of Lincolnshire. Reductions in acreage are heaviest in Lancashire and Norfolk, each with 9,000 acres less, Essex and Cambridge with 7,000 acres less, and Cheshire with 6,000 acres less than in 1928.

The acreage under barley at 1,122,000 acres shows a reduction of 63,000 acres or 5·3 per cent. from that of last year. No counties show any increase of importance, while the barley areas of the Northern, North-Eastern and Eastern Divisions for the most part show substantial reductions. The Yorkshire barley area is reduced by 19,000 acres; Lincolnshire shows a loss of 13,000 acres, while Suffolk and Norfolk return 8,000 acres less than last year.

Oats have been grown on an area of 1,852,000 acres, which is larger by 89,000 acres, or 5 per cent., than last year's acreage. Increased acreages are general throughout the country except in the South-Eastern counties, and are relatively heaviest in the two Midland divisions.

There is a marked increase in the area under mixed corn, which is 140,700 acres, or 21,400 acres, or 18 per cent., more than in 1928. The Eastern and East-Midland Divisions show increases of about 90 per cent., while the South-Western Division, where practically 50 per cent. of this crop was grown in 1928, shows little change.

Very general increases in the acreage under rye bring the total acreage for this year to 34,700 acres compared with 30,500 acres in 1928.

Beans and Peas.—The total area under beans is 156,800 acres or 13,200 acres less than in 1928. This decrease, which is general except in Yorkshire and in the South-West, is entirely in beans for harvesting as corn which are being grown on 143,900 acres, or 13,600 acres (8·6 per cent.) less than in 1928. The acreage of beans picked green shows an increase of 400 acres, or 3·2 per cent. The total area of peas is 132,400 acres, an increase of 18,400 acres compared with 1928. Peas for harvesting as corn occupy 78,600 acres, the remaining 53,800 acres being under peas to be picked green, the increase as compared with 1928 being about 9,000 acres in each case.

Potatoes.—The area under potatoes is larger than in any year since 1922, the total acreage of 518,900 acres being 30,000 acres, or 6 per cent. higher than in 1928. Increased acreages were returned from the great majority of countries, the heaviest increases being in Lincolnshire with 9,100 acres, Isle of Ely with 4,400 acres, and Yorkshire with 3,800 acres more than in 1928.

Sugar Beet.—The net increase in the area under roots is due to an appreciable addition, amounting to 54,200 acres, in the acreage of sugar beet, which is 229,900 acres, or nearly 31 per cent. more than in 1928. This is the highest acreage yet recorded for this crop. The greater part of the increase is shown in the Eastern and North-Eastern divisions, but the relatively heaviest increases were in the South-Eastern and South-Western divisions, which increased their 1928 acreages by over 50 and 100 per cent. respectively. The largest county increases are 12,300 acres in Norfolk; 10,000 acres in Lincolnshire; 8,000 acres in Suffolk; 5,000 acres in the Isle of Ely, and 3,000 acres in Essex.

Fodder Roots.—The area under turnips and swedes is 699,100 acres, a drop of 23,200 acres, or 3·2 per cent., as compared with 1928. The decrease is distributed over most of the counties in England, except in the East-Midland counties, and about one-half of the Welsh counties.

The greatest actual acreage decrease is 6,200 acres in Norfolk. The acreage of mangolds shows a small increase of about 700 acres, the total area returned as under this crop being 299,100 acres. About one-half of the counties in England and Wales show increases, but the variations in acreage are generally small.

Vegetables.—Most vegetables were being grown on increased acreages, the most notable exceptions being brussels sprouts, which show a reduction from 30,400 acres to 26,700 acres, and celery, which shows a negligible drop from 5,800 acres to 5,700 acres. Cabbage for human consumption was more widely grown in most counties, and shows an increase from 27,900 acres to 32,400 acres.

Cauliflower and broccoli has increased by 400 acres to 13,900 acres; carrots by 300 acres to 10,300 acres; rhubarb by 200 acres to 7,200 acres, and onions by 700 acres to 2,400 acres, the increase in the acreage of onions being over 40 per cent.

Other Crops.—There is practically no change in the total acreages under fodder cabbage, kohl-rabi, and rape or under vetches. More variation is shown in the acreage under lucerne and mustard for seed, the former showing a reduction from 37,100 acres to 35,800 acres, and the latter a reduction from 26,800 acres to 23,100 acres. An appreciable addition is shown in the acreage of linseed, which is increased from 2,600 acres to 3,200 acres. The acreage under hops is only very slightly more than in 1928.

Fruit.—The total acreage of orchard and small fruit remains about unchanged from that of last year, the acreage of orchards being 248,200 acres or 200 acres less, and that of small fruit being 64,900 acres or 200 acres more than in 1928. The greatest changes in orchard acreages are reductions of 635 acres in Worcester, 307 acres in Hereford, and 329 acres in the Holland division of Lincolnshire. Kent, on the other hand, returned an increase in orchards of 995 acres. Variations in the acreage of the different kinds of small fruit were practically negligible. The strawberry acreages at 20,400 acres is very slightly less than in 1928. Raspberries occupied 6,000 acres compared with 6,200 acres last year, while currants and gooseberries at 34,800 acres show a small increase.

Clover and Rotation Grasses and Meadow Hay.—The total acreage returned as under clover and rotation grasses is 2,370,000 acres or 67,000 acres less than in 1928. The proportion of this total acreage contributing to the hay harvest is 1,524,000 acres, a reduction of 44,000 acres compared with the previous year. The acreage of meadow hay, however, has risen from 4,500,000 acres to 4,695,000 acres, an increase of 195,000 acres. The total area from which the hay crop for this year is drawn thus shows an increase of 151,000 acres on that of 1928, and is the highest hay acreage since the war with the exception of that of 1924.

Bare Fallow.—The favourable conditions which existed for cultivation were probably responsible for the very marked reduction in the area returned as bare fallow. The total area so returned is 325,200 acres or 142,900 acres (30·5 per cent.) less than in 1928. The reduction is shared by almost every county, the most notable reductions being those of 15,000 acres in Yorkshire; 14,000 acres in Essex; 11,000 acres in Lincolnshire; 8,310 acres in Suffolk and 6,060 acres in Herts.

LIVE STOCK

The numbers returned as on agricultural holdings on June 4, 1929, are less than in the previous year in respect of all kinds of live stock. The reductions, however, are relatively small in the cases of cattle and sheep, being 1·2 and 1·8 per cent. respectively. Horses are fewer

by 3·8 per cent. than in 1928, while pigs show a reduction of 20 per cent.

CATTLE

	1929	1928	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Cows and Heifers in Milk ..	2,053,600	2,066,500	—	—	12,900	0·6
Cows in Calf, but not in Milk ..	293,600	301,700	—	—	8,100	2·7
Heifers in Calf ..	364,500	355,200	9,300	2·6	—	—
Other Cattle :—						
Two years and above ..	998,700	1,008,100	—	—	9,400	·93
One year and under two ..	1,143,400	1,175,000	—	—	31,600	2·7
Under one year	1,102,200	1,119,900	—	—	17,700	1·6
TOTAL OF CATTLE	5,956,000	6,026,400	—	—	70,400	1·2

The total number of cattle again shows a decrease, the reduction being 70,400 or 1·2 per cent. as compared with a reduction of nearly 4 per cent. decrease recorded last year. The falling off in the number of cattle is relatively least in the dairy herd, cows and heifers in milk being reduced by 12,900 or less than 1 per cent., while cows in calf but not in milk and heifers in calf show a decrease of 8,100 (2·7 per cent.), and an increase of 9,300 (2·6 per cent.) respectively. Other cattle are mainly responsible for the decline in the total number, cattle under one year being fewer by 17,700 or 1·6 per cent., cattle one year and under two being 31,600 or 2·7 per cent. less, while older cattle are fewer by 9,400 or ·93 per cent. Reductions in the number of dairy cattle are fairly general except in the Eastern and East Midland divisions, where several counties returned small increases, notwithstanding which all divisions show a net decrease in the dairy herd. As regards other cattle, however, the Eastern, North-Eastern and Northern divisions show a small net increase in cattle over one year old, while the South-Eastern and South-Western divisions return small increases in other cattle under one year old. The number of bulls being used for service shows a small reduction from 82,100 to 82,000.

SHEEP

	1929	1928	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Ewes kept for Breeding ..	6,712,400	6,846,900	—	—	134,500	2·0
Other Sheep :—						
One year and above ..	2,471,200	2,570,800	—	—	99,600	3·8
Under one year	6,919,800	6,981,900	—	—	62,100	0·9
TOTAL OF SHEEP	16,103,400	16,399,600	—	—	296,200	1·8

As in the case of cattle the reduction in the total number of sheep returned is appreciably less than that shown last year, being 296,200 or 1·8 per cent. as compared with a reduction of 686,200 or 4 per cent. recorded in 1928. The reduction in the number of breeding ewes is slightly heavier than in 1928, being 134,500 or 2 per cent. while other sheep show considerably less reduction than last year. Sheep under one year are fewer by 82,100 or less than 1 per cent., while older sheep are reduced by 99,600 or 3·8 per cent. The decline in the number of breeding ewes is shared by the majority of counties throughout the country except in the East and West Midland divisions and in the Northern division, where most counties show an increase. Only one division, the South-Western, shows an increase in its total number of sheep. The number of rams and ram lambs to be used for service in 1929 shows an increase from 191,500 to 203,700.

PIGS

	1929	1928	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Sows kept for Breeding ..	306,800	380,000	—	—	73,200	19
Other Pigs ..	2,057,700	2,591,000	—	—	533,300	21
TOTAL OF PIGS..	2,364,500	2,971,000	—	—	606,500	20

The substantial increase which brought the total number of pigs in 1928 within measurable distance of the record number of 1924 has been followed this year by the heaviest reduction recorded in any year since 1892. The decrease as compared with the number returned last year is 606,500 or 20 per cent. The number of sows kept for breeding is reduced by 73,200, or 19 per cent., while other pigs show a decrease of 533,300, or 21 per cent. Reductions in both classes of pigs are shown by every county. The number of boars being used for service declined from 26,200 to 25,600.

HORSES

	1929	1928	Decrease	
	No.	No.	No.	Per cent.
Horses used for Agricultural purposes (including Mares for Breeding) ..	706,700	732,500	25,800	3·5
Unbroken Horses (including Stallions) :—				
One year and above ..	89,200	96,300	7,100	7·4
Under one year ..	37,500	38,200	700	1·8
Other Horses ..	165,700	171,500	5,800	3·4
TOTAL OF HORSES ..	999,100	1,038,500	39,400	3·8

The total number of horses on agricultural holdings this year shows a similar reduction to that recorded in 1928, the actual decrease being 39,400 or 3·9 per cent. Of this decrease the decline in the number of horses used for agricultural purposes (including mares for breeding) accounts for 25,800, which is almost double the reduction shown in

this section last year. On the other hand the number of foals, at 37,500, is only 700 less than in 1928, the reduction being under 2 per cent. as compared with a reduction of 2,100 or 5 per cent. shown last year. The decrease in the number of foals this year is wholly in light horses, heavy foals showing a slight increase.

The number of stallions being used for service shows an increase from 2,995 to 3,142.

HOPS

Acreage of Hops.—Preliminary statement compiled from the returns collected on June 4, 1929, showing the acreage under hops in each county of England in which hops were grown, with a comparative statement for the years 1928 and 1927.

Counties, &c.				1929	1928	1927
				Acres	Acres	Acres
Kent	{	East .. ..	..	3,230	3,280	3,170
		Mid .. ..	..	4,900	4,940	4,790
		Weald .. ..	..	6,660	6,580	6,330
		Total, Kent ..	..	14,790	14,800	14,290
Hants .. ..	..	..	..	1,010	990	950
Hereford ..	..	..	..	3,860	3,780	3,590
Surrey .. ..	..	..	..	160	160	150
Sussex .. ..	..	..	..	2,140	2,150	2,150
Worcester ..	..	..	..	1,810	1,790	1,770
Other Counties	..	..	..	130	130	100
Total .. ..	..	..	..	23,900	23,800	23,000
				*	*	*

THE KENT FARM INSTITUTE

G. H. GARRAD, N.D.A.

Agricultural Organizer for Kent.

KENT is following the lead of other important agricultural counties by opening in October a farm institute of its own, with the assistance of liberal grants from the Ministry of Agriculture. The Institute is situated in pleasant surroundings between the village of Borden and the town of Sittingbourne, just over a mile from Sittingbourne railway station, in a district famous for the cultivation of fruit and hops. It occupies the buildings of the old Borden Grammar School, erected in 1878, but the whole place is now being remodelled, brought thoroughly up-to-date, and completely equipped for teaching the various sciences connected with agriculture. The buildings include a large lecture room, two smaller lecture rooms, two laboratories, two students' common rooms, a staff common-room, a carpenter's shop, a blacksmith's shop, a large dining hall, single cubicles for 40 resident students, accommodation for two resident members of the staff, the matron and domestic staff, and the Principal's residence. The buildings stand in 7 acres of land.

Three-quarters of a mile away is the Institute Farm. The soil is clay-with-flints overlying the chalk, and the farm is a typical Mid-Kent farm. It is 250 acres in extent and includes 72 acres of fruit orchards and plantations, 10 acres of hops, 125 acres of arable crops and 40 acres of grass. Field work is carried out both by tractor and horses. Livestock on the farm includes 6 working horses, a breeding flock of 200 Kent ewes and 7 breeding sows. A new and up-to-date cowshed and dairy for 12 cows is being erected and poultry equipment is being provided for 1,000 laying birds.

The object of the Farm Institute is, by educational means, to assist the agricultural industry of the county. The courses are designed to meet the needs of the sons of working farmers, farm bailiffs, fruit growers, fruit foremen, &c. Exceptional facilities exist for training in commercial fruit growing.

Instruction will be given partly by means of lectures and laboratory work, and partly by work connected with the general farm, fruit plantations, poultry, garden and other departments. Students should be at least 16 years of age, and preferably older, and it is desirable that they should have had at least a year's practical experience of work on a farm. Any student desiring to enter the Institute before he has gained some practical experience is advised to attend for one or more terms for practical work only before joining an organized course.

Fees for board, lodging and tuition (but exclusive of laundry) for all courses are :—

Kent students	£1 per week.
Extra-county students ..	£2 per week.

Students living in the neighbourhood may, if they wish, enter as day-students at 7s. 6d. per week for tuition only, meals extra.

A number of scholarships are awarded in connexion with each course. They are not offered as prizes for educational efficiency, but to assist parents whose means are insufficient to enable them to pay the moderate fees required. All applicants for scholarships are interviewed by representatives of the Farm Institute Sub-Committee. Two classes of scholarship are offered, reduced-fee places, entitling holders to attend the Institute at the reduced fees agreed upon, and free-places, entitling holders to attend without payment of any fees at all. There is no written entrance examination for any students, whether scholarship candidates or otherwise, but candidates must be able to satisfy the Farm Institute Sub-Committee

that their general educational attainments are sufficient to enable them to profit from the instruction provided.

The Session is divided into three terms, of approximately 11 weeks each, in the autumn, spring and summer. There are two main courses of instruction, one in agriculture and the other in commercial fruit-growing and market-gardening. Each of these courses will start in October. Students are recommended to take the full three-term course, but applicants will be accepted for the two winter terms only, if it is not possible for them to be away from their farms in the summer.

Instruction in practical poultry-keeping will be given throughout the year, and students will be received at any time for long or short periods according to their requirements. Intending students are warned, however, that a knowledge of poultry management cannot be acquired in a few weeks, and those who are not familiar with routine work are strongly advised to attend for at least three terms, thus gaining experience of the operations of the whole poultry year.

It is also proposed to arrange short courses of instruction in milk production, pruning of fruit trees, grafting and budding, hop-drying, &c. If accommodation is available, students will be accepted purely for practical work. Some of these students might go to Wye College in the following autumn or stay on for a winter course at the Institute. The fees payable will be the same as for other students.

Instruction will be given by the Principal and his two resident assistants, certain other members of the County staff, and part-time instructors. Members of the Institute staff are required to do work in the County, as well as at the Farm Institute; thus the life and teaching of the Institute will be intimately linked up with the life and work of the agricultural community in the County.

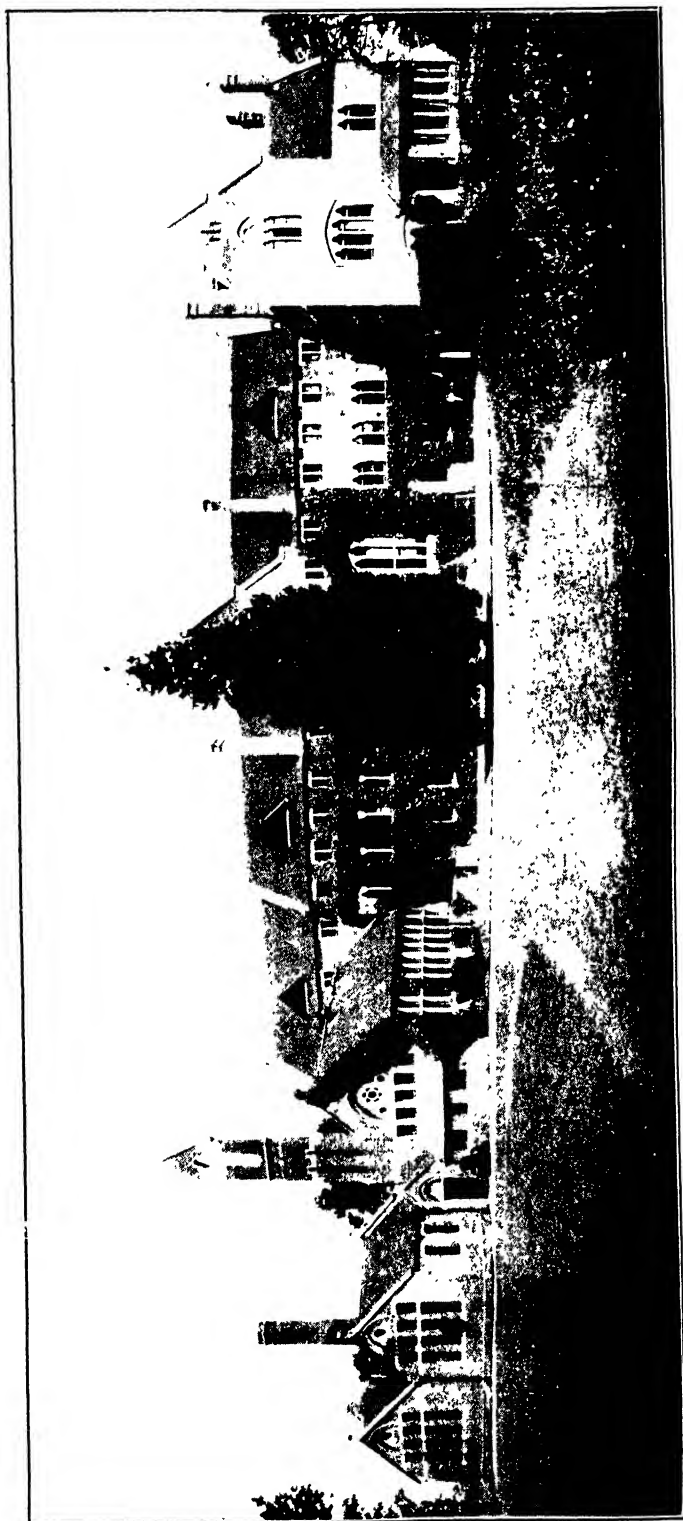
The following appointments have been made to the Farm Institute Staff:—

Principal: Mr. T. W. McDougall Porter, M.C., N.D.A., who for nine years has been Assistant to the County Agricultural Organizer.

Instructor in Commercial Fruit Growing and Market Gardening: Mr. R. Hart, N.D.A., N.D.D., who for five years has been Instructor in commercial fruit growing and market gardening at the East Anglian Institute of Agriculture.

Instructor in Agriculture: Mr. E. A. Bartlett, N.D.A., who for two years was practical farm instructor at the East Sussex Farm Institute at Plumpton, and has recently been managing a large farm near Eastbourne.

Matron: Miss H. H. Warskitt, previously matron to the Hertfordshire Institute of Agriculture at St. Albans.



The Kent Farm Institute, Borden.

The first session will start on or about Monday, October 7, 1929. Application forms for admission, either at full fees or as Kent scholarship students, can be obtained from the Agricultural Organizer, Springfield, Maidstone.

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SEPTEMBER ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),

Agricultural Organizer for Derbyshire

Crops and Moisture Supply.—The first seven months of the year will be remembered with the corresponding period of 1921 as an exceptionally dry growing season. The rainfall recorded at Derby from January 1 to July 31 totals 8·37 in., compared with 8·45 in. in 1921 and 15·46 in. on the average of the 20 years 1900 to 1920.

In the Midlands the drought affected grass more than corn crops, and green crops less than either—cabbages excepted as having been attacked by root maggot. Roots are regarded as moisture-loving crops and they do indeed utilize large quantities during their growth: a 20-ton crop of roots represents a water consumption of about 1,000 tons, or 10 inches of effective (i.e. penetrating) rain—probably 20 inches of actual rain. In spite of lack of rain after the crops were drilled, however,—and the soil was unusually dry at seeding time—the mangolds, kale and swedes continued to thrive. Naturally the question has often arisen as to where the necessary moisture was being obtained.

Formerly it was taught that moisture ascended by capillary action from a damp or saturated layer—the water table—in the subsoil. Recent work has cast considerable doubt on the importance of capillarity as a means of raising appreciable quantities of moisture from damp layers in the subsoil: a water table in the soil or subsoil is exceptional. Root fibres penetrate, however, to much greater depths than farmers commonly realize; and, in soils that are not underlaid by porous gravel or by an acid subsoil (which is inimical to root distribution), crops can, by deep rooting, utilize moisture in the under layers to supplement that obtainable by their more superficial root fibres.

There is another possible source of moisture, viz., the absorption of water vapour from the atmosphere during the night. Investigations carried out at the Montpellier (France) Experimental Station in 1925 and 1926 led to the conclusion that this was the chief cause of soil humidity during the hot season. It was found to be a phenomenon distinct from dew

formation, occurring regularly and commencing about 2½ hours before sunset. The amount of water so afforded to the soil and plants was equivalent to about 1½ inches of effective rain per month (*Internat. Review Agric.*, Dec., 1927). Perhaps this property of soils explains the beneficial effect of surface stirring and loosening as an aid to drought resistance and why root crops are less dependent on rain than meadows and pastures.

Spring cultivations affect the power of the soil to resist drought, late ploughing being particularly risky on this account. Recently I heard of a case in Salop where part of a field had been prepared for mangolds without spring ploughing while the other had been spring ploughed, with the result that during the dry weather of July the plants on the latter half of the field to the last furrow wilted in the late afternoon while those on the other portion remained turgid. It is open to argument whether the main cause of the wilting tendency was, as the informant contended, that the ploughing had broken the capillary connexion with the subsoil, or, as the writer urged, that the ploughing operation had caused considerable loss of moisture from both soil and subsoil. From the practical point of view, the important issue is the desirability—as often urged in these notes—of preparing the tilth for roots without deep inversion of the soil near the time of sowing: the necessary ploughing should be done in autumn or winter.

Field Operations.—Permanent grasslands generally receive little special treatment in September, except harrowing to spread droppings, where the management is very progressive, and perhaps the completion of mowing of thistles and tussocks where operations are belated. The scouring of ditches is typical September work, while the cleaning of ponds and other watering places before they fill up again is similarly opportune. On many farms the ponds have been badly neglected for many years, with the result that the task is now a serious one where steam tackle is not available. The use of an unloading jib, with a suitable box in place of the hay fork is one way of saving labour and strain for both men and horses. After a pond or watering place has been cleaned, however, it should be fenced off and arrangements made whereby stock can drink without being able to pollute the water supply. Dirty, unfenced ponds and sewage-contaminated streams are often associated with ill-health and bacterial diseases in cattle.

September is a month of considerable activity on the arable parts of the farm. In an early harvest season such as this, most of the stubbles may have been cleared of stooks before the middle of the month; and wet periods during harvest time will have been utilized in clearing cattle courts and in manuring and ploughing seed layers intended for wheat. Apart from the risk of frit-grub attack after late-ploughed leas, wheat comes up better and winters more successfully on a stale than on a newly turned grass furrow.

While priority is generally given to lea ploughing, it is desirable that this work should be completed early so that no opportunity for stubble cultivations is lost. Stubbles intended to be sown with beans may be left if necessary until the time when ploughing and drilling can be done simultaneously; those to be drilled with wheat, however, should be ploughed or at least skimmed as soon as possible. On fairly clean land, the one furrow of about 5 to 6 inches depth is suitable treatment: sometimes hand forking is sufficient, where there are only a few beds of twitch. On the other hand, where the stubble of the last corn crop is rather dirty, a preliminary skimming and cleaning is necessary.

Although early stirring and the lapse of several weeks between the first working of the soil and drilling of the seed may be important for the wheat crop, the claims of the land intended for sugar beet and mangolds in 1930 must also be considered. Continental beet growers are unanimous in their opinion of the value of a preliminary early stirring some time before the deep autumn ploughing. Apart from the opportunity for weed extraction which stubble skimming affords, it greatly favours the production of good deep tilth in the following spring; the admission of early autumn rains is another consideration. It is at this season that reserve power, either in the form of tractor equipment or spare horses, is so valuable. Various implements may be used for the purpose of stubble skimming; on clean land the disc harrow is one of the best; but whatever the implement or source of power, the state of the soil at the time of the operation is a controlling factor. As mentioned on previous occasions, the soil is generally most workable immediately after the corn has been cut, before it has hardened.

Live Stock.—All kinds of live stock require special consideration in September. In the dairy herd there are dry cows due to calve in this or the next month, and, apart from the contentious point of whether "steaming up" on palm kernel

cake prevents milk fever, it is beyond doubt that good body condition without costiveness is desirable. 'A little reserve of fatty tissue helps the cow through the first few weeks of lactation, when the output of nutrients in the form of milk may exceed the intake in the shape of food ; and deep milkers in good flesh at this period are less liable to yield milk deficient in fat than are those which calve down in poor condition.

With a new milk recording year beginning on October 1, the desirability of joining a society may well be considered in this month. Some members, especially breeders rather than buyers of dairy cattle, have admittedly been somewhat disappointed with their results in the matter of herd-average yield. It is doubtful, however, whether the figure obtained by averaging the yields of "full year cows" in the ordinary way is a fair criterion for the comparison of different herds. The shrewd competitor gains a considerable advantage in this matter if he calves his heifers down for the first time after October 1 ; but it is commonly better farm practice to bring them into the herd in July and August. This not only ensures few barreners but it also allows of a little longer rest between the first and second calvings without converting the young cow into a spring calver. Heifers in milk, it should be recognized, should be fed liberally, to allow for growth as well as milk production ; and what has been said about calving cows in good condition applies with emphasis to first calvers.

September is the month in which hill farmers dispose of their draft ewes and their wether lambs, special sales being held at Craven Arms, Shrewsbury and elsewhere. Farmers who are able to feed very early lambs bid keenly for the ewes offered at the first sales, lower prices ruling later. Last year good Kerries cost about 80s., but smaller sheep and Kerries at later sales could be bought for 70s. and under. With a slight reduction in the number of ewes in the country and a hardening tendency in the prices of store sheep it is likely, in spite of hay shortage, that last year's prices will be fully maintained. Nevertheless farmers who are able to run a flying flock for the production of early lamb will have difficulty in finding a better investment.

In September the laying flock should consist of this year's pullets, installed in place of the two-year olds recently culled out, together with the best of the year olds. This season the latter have moulted comparatively early, and if fed on

suitable rations should commence to lay again before the end of the summer. It is remarkable what a difference in the financial returns of poultry keeping may be effected by good housing, suppression of red mite—which is often found about the end of perches—and correct feeding. The use of about 10–15 per cent. of meat and bone meal in the mash and limitation of the corn allowance are the essentials of sound feeding; but farmers often omit to supply oyster shell or limestone grit and thereby reduce the egg output.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended August 14.				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	9 9d	9 9d	9 9d	9 9d	12 2
Nitro-chalk (N. 15½%) ..	10 0f	10 0f	10 0f	10 0f	12 11
Sulphate of ammonia:—					
Neutral (N. 20·6%)..	9 9d	9 9d	9 9d	9 9d	9 2
Calcium cyanamide (N. 20·6%)	8 10e	8 10e	8 10e	8 10e	8 3
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%) ..	..	10 10h	..	..	..
Kainit (Pot. 14%) ..	3 6	2 19	2 19	2 17	4 1
Potash salts (Pot. 30%) ..	5 3	..	4 17	4 13	3 1
„ (Pot. 20%) ..	3 15	3 9	3 8	3 7	3 4
Muriate of potash (Pot. 50%)..	9 17	9 3	9 2	8 10	3 4
Sulphate,, „ (Pot. 48%)..	11 19	11 6	11 5	10 7	4 4
Basic Slag (P.A. 15½%)||	2 13c	2 3c	..	2 9c	3 1
„ (P.A. 14%)||	2 7c	1 16c	1 16c	2 3c	3 2
„ (P.A. 11%)||	..	1 9c	1 9c	..	..
Ground rock phosphate(P.A.26·27½%) ..	2 10||	2 5||	..	2 5a	1 8
Superphosphate(S.P.A.16%)..	3 7	..	3 6	3 6	4 2
„ (S.P.A.13½%)..	3 2	2 15	3 0	3 0	4 4
Bone meal(N.3½%,P.A.20½%)..	8 15	8 10	8 12	8 0	..
Steamed bone flour (N. ½% P.A. 27½-29½%) ..	5 17b	..	6 10	5 5	..

Abbreviations: N. = Nitrogen; P.A. = Phosphoric Acid; S.P.A. = Soluble Phosphoric Acid; Pot. = Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage-paid price.

† Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‡ Fineness 80% through standard sieve. a. 85% through standard sieve.

§ Delivered (within a limited area) at purchaser's nearest railway station.

• Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

¶ For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 6s. per ton extra.

• Delivered in 4-ton lots at purchaser's nearest railway station.

† Prices for 2-ton lots. Rebate of 1s. per ton will be allowed.

‡ F.o.r. Gooles.

NOTES ON FEEDING STUFFS

H. G. SANDERS, M.A., Ph.D.,

School of Agriculture, Cambridge.

The End of the Grazing Season.—We are now approaching the end of the grazing season, and very great care is necessary at this time, so that animals which will in the near future be transferred from pasture to winter feeding may not suffer a set-back. Considerable space was devoted last month to the nutritive value of grass, and one point which is of great importance might be repeated—the fact that there is very little variation in the composition of the herbage right up to the end of the grazing season. There is, to be precise, a very slight decline in its digestibility, but it is only of the order of 2 to 3 per cent., and so has no great importance under practical conditions. This, it will be remembered, is true if, and only if, the pasture is kept well eaten down. Shortly, however, growth will slow down practically to a standstill, and then the grass cannot provide a concentrated food suitable as the production part of the ration. It will be realized that grass growth is subject to several different limiting factors: (1) during winter it is practically prevented by low temperature, and this also causes considerable variation all through the summer; (2) warm weather, however, is often accompanied by low rainfall, and then the absence of water in the soil takes the place of temperature as the limiting factor; (3) as soon as we get on into October there will be yet another, for warm wet weather will not then evoke a full response, the limiting factor being the number of hours of daylight, for plants grow by means of a process known as photo-synthesis.*

If the herbage is short and growing, it may still provide very valuable food for nearly all classes of stock, even though a hay crop was taken earlier, for Dr. Woodman has found that aftermath, if kept well down, approaches very closely in composition to grass that has been closely grazed all the summer. Growth, however, will be slowing up, and in most cases with animals making large productions (such as milking cows and baby beef) some supplementary food will be necessary. It is a

* This term is used to describe a little-understood mechanism by which plants are capable of taking carbon from the carbon dioxide of the air, and combining it with water (taken up by their roots) to form carbohydrates—sugars, at first, which are later converted into starch. One of the few things known about the process is that it requires a certain intensity of light, so that this probably provides the explanation of the slow growth of grass in the autumn, even though all the other conditions are favourable.

very difficult matter to decide the nature and amount of this supplementary food, because in addition to judging the value of the grass eaten—that is, its state of growth—an estimate must be made of how much of it each type of animal will eat, and for this we can only go on what is usually taken to be the dry matter capacity of the animal. The following table (taken from Dr. Woodman's report of last year) illustrates the problem :—

	Dry matter capacity (lb.)	Standard Requirement		Consumed on Young Grass	
		S.E. (lb.)	Dig. Prot. (lb.)	S.E. (lb.)	Dig. Prot. (lb.)
3-gallon cow	30	14	2.5	21.0	6.0
6-gallon cow	30	21	3.7	21.0	6.0
9-gallon cow	30	29	6.1	21.0	6.0
10-cwt. steer	24	12.5	1.5	16.8	4.8
6-cwt. steer	17	9.2	1.4	11.9	3.4
(baby beef)					
13-cwt. steer	28	15.9	1.8	19.6	5.6
(fattening)					
100-lb. sheep	3.5	2.2	0.25	2.5	2.7
(fattening)					

There is, of course, no one food or mixture which forms an ideal supplement to such grass, for the other foods must be varied according to the class of stock for which they are intended, but it is clear that supplements should be starchy foods, which are also the cheaper ones. One may assume that if other feeding stuffs are given less grass will be eaten, but it is extremely improbable that it will fail to supply protein in plenty. Of course, the usual run of pasture which has not been kept down all the summer will be in a different state now, and will contain a large proportion of mature herbage which will have a lower content of protein, but it is probable that even in that case its "nutritive ratio" will be no wider than required in a balanced ration, so that the most expensive cakes with high protein will be unnecessary.

The whole question of supplementary feeding on pasture has not received from investigators the attention which its importance warrants, but the few actual trials that have been made indicate that cereals are as effective as higher priced foods—such as linseed cake. A Russian worker (Lavinor) recently tried several foods as supplements to grass of what he regarded as average quality, and found that their effectiveness was in the order : millet, oats, linseed cake, bran, barley. It may be emphasized that first and second places were taken by cereals. Two American workers (Hayden and Perkins) also tried high and low protein supplements, and found them equally effective, the latter being, of course, much the cheaper. Some people have

found it desirable to feed a supplement all the time the cows are on grass : Eckles, in America, decided that the feeding of cereals to cows under these conditions, whilst not giving an economic return at the time, paid in the long run, because the cows kept up their yields better during the back end of the season.

This latter is a very important point, for it means more milk at the time of the year when the price is highest. Probably one of the chief reasons why farmers have not, in the past, paid sufficient attention to supplementing pasture is the low price they obtain for their milk during the summer. There appears to be no inducement to better summer feeding, especially whilst we have the surplus milk problem with us, but yearly outputs would undoubtedly be raised very considerably if it were improved, and farmers would probably be keener on the question did they realize that a large part of the benefit would be reaped during the time when milk commands a comparatively high price.

Particular attention should be paid to cows calving this month and in the beginning of October, for poor conditions at the outset of the lactation lead to a rapid falling away of the yield, which it is often very difficult, or impossible, to make up later. The writer's examination of records of Norfolk cows showed that October calvers gave, on the average, over 5 per cent. more milk in the lactation than September calvers, and this extra amount, though small, is important, for what profit there is must be sought in the last 5 per cent. October calvers are usually put straight on to winter feed, but September calvers have a short time on summer feed first—just at the end of the grazing season, when farmers are quite naturally trying to put off full winter rations as long as possible. In this short spell wellnigh irreparable damage may be done to the September calvers' lactation yields, if their level of yield is brought down very rapidly ; in actual fact the Norfolk September calvers fell off 14.5 per cent. in their yield from the third week (when they were at their highest) to the tenth week, as compared with 11.6 per cent. for October calvers. This difference was maintained all through the winter, the October calvers being on a definitely higher level all the time. It is well known that autumn calvers give more milk than spring and summer calvers, the accepted reason being that they are not subject to the summer and early autumn drops, but milk steadily on with only a slow decline right through. Dr. Eschweiler of Belgium made a very strong point of this at last year's World's Dairy Congress, and laid great stress on the desirability of farmers

calving their cows after the upsetting change over from summer to winter conditions.

It is obviously impossible at this stage to arrange for cows to calve a little later, nor would the writer recommend the earlier bringing in of herds, for that would lengthen the more expensive winter feeding period. It should be recognized, however, that the near future is a time when feeding conditions are usually bad, and consequently the greatest care should be taken in watching the grass, and in giving suitable and adequate supplements. In the case of cows whose lactation has nearly run its course no great harm can be done, but with those freshly

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	9 16
Maize	81	6.8	10 2
Decorticated ground nut cake	73	41.0	13 0
„ cotton cake	71	34.0	11 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2.61 shillings, and per unit protein equivalent, 1.66 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The “food values” which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1928, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	10 4
Oats	60	7.6	8 9
Barley	71	6.2	9 16
Potatoes	18	0.6	2 8
Swedes	7	0.7	0 19
Mangolds	7	0.4	1 0
Beans	66	20.0	10 5
Good meadow hay	37	4.6	5 4
Good oat straw	20	0.9	2 14
Good clover hay	38	7.0	5 11
Vetch and Oat silage	13	1.6	1 17
Barley straw	23	0.7	3 1
Wheat straw	13	0.1	1 14
Bean straw	23	1.7	3 8

DESCRIPTION	Price per qr.		Price per ton		Manu- rial value per ton	Cost of food value per ton		Starch equiv. per 100 lb.	Price per unit starch equiv.		Price per lb. starch equiv.	Pro- tein equiv. %
	s. d.	lb.	£ s.	£ s.		£ s.	£ s.		s. d.	d.		
Wheat, British	—	—	12 5	0 12	11 13	72	3 3	1-74	9-6			
Barley, British feeding ..	—	—	10 5	0 10	9 15	71	2 9	1-47	6-2			
" Canadian No. 4 Western ..	35 9	400	10 0*	0 10	9 10	71	2 8	1-43	6-2			
" " feed	34 3	—	9 12*	0 10	9 2	71	2 7	1-38	6-2			
" American	35 0	—	9 17	0 10	9 7	71	2 8	1-43	6-2			
" Persian	34 9	—	9 15	0 10	9 5	71	2 7	1-38	6-2			
Oats, English, white	—	—	10 7	0 11	9 16	60	3 3	1-74	7-6			
" " black and grey ..	—	—	9 10§	0 11	8 19	60	3 0	1-61	7-6			
" Canadian mixed feed ..	21 6	320	7 10	0 11	6 19	60	2 4	1-25	7-6			
" Argentine	26 6	—	9 5	0 11	8 14	60	2 11	1-56	7-6			
" Chilean	25 9	—	9 0	0 11	8 9	60	2 10	1-52	7-6			
Maize, American	43 3	480	10 3§	0 10	9 13	81	2 5	1-29	6-8			
" Argentine	43 0	—	10 0	0 10	9 10	81	2 4	1-25	6-8			
" South African	43 6	—	10 3§	0 10	9 13	81	2 5	1-29	6-8			
Peas, Japanese	—	—	17 15§	1 2	16 13	69	4 10	2-59	18			
Dari	—	—	10 0	0 12	9 8	74	2 6	1-34	7-2			
Millers' offals—												
Bran, British	—	—	7 0	1 2	5 18	42	2 10	1-52	10			
" broad	—	—	7 17	1 2	6 15	42	3 3	1-74	10			
Middlings, fine, imported ..	—	—	8 15	0 18	7 17	69	2 3	1-20	12			
" coarse, British	—	—	8 0	0 18	7 2	58	2 5	1-29	11			
Pollards, imported	—	—	7 12	1 2	6 10	60	2 2	1-16	11			
Meal, barley	—	—	10 12	0 10	10 2	71	2 10	1-52	6-2			
" maize	—	—	11 0	0 10	10 10	81	2 7	1-38	6-8			
" " South African	—	—	9 12	0 10	9 2	81	2 3	1-20	6-8			
" " germ	—	—	10 0	0 15	9 5	81	2 3	1-20	10			
" locust bean	—	—	9 5	0 8	8 17	71	2 6	1-34	3-6			
" bean	—	—	13 0	1 5	11 15	66	3 7	1-92	20			
" fish	—	—	19 0	3 8	15 12	53	5 11	3-17	48			
Maize, cooked flaked	—	—	12 5	0 10	11 15	85	2 9	1-47	8-6			
" gluten feed	—	—	9 15	1 0	8 15	76	2 4	1-25	19			
Linseed cake, English, 12% oil ..	—	—	13 10	1 10	12 0	74	3 3	1-74	25			
" " " 9% "	—	—	13 0	1 10	11 10	74	3 1	1-65	25			
" " " 8% "	—	—	12 15	1 10	11 5	74	3 0	1-61	25			
Soya bean	—	—	11 12	2 2	9 10	69	2 9	1-47	36			
Cottonseed cake—												
English 44% "	—	—	7 15	1 8	6 7	42	3 0	1-61	17			
" " Egyptian, 44% " ..	—	—	7 10	1 8	6 2	42	2 5	1-29	17			
Coconut cake, 6% oil	—	—	10 12	1 5	9 7	79	2 4	1-25	16			
Ground-nut cake, 6-7% oil	—	—	9 15*	1 8	8 7	57	3 0	1-61	27			
Decorticated ground-nut cake, 6-7% oil	—	—	13 0*	2 3	10 17	73	3 0	1-61	41			
Palm kernel cake, 4-5% oil ..	—	—	10 0†	0 18	9 2	75	2 5	1-29	17			
" " " meal, 4% "	—	—	10 10†	0 18	9 12	75	2 7	1-38	17			
Feeding treacle	—	—	6 7	0 8	5 19	51	2 4	1-25	2-7			
Brewers' grains, dried ale	—	—	8 15	0 19	7 16	49	3 2	1-70	13			
" " " " porter	—	—	8 5	0 19	7 6	49	3 0	1-61	13			
Malt culms	—	—	8 15§	1 8	7 7	43	3 5	1-83	16			

* At Bristol.

† At Hull.

§ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of July and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22-4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1-43d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 6d.; P₂O₅, 3s. 6d.; K₂O, 3s. 1d.

calved there is a danger of spoiling their records before their milking period is a month old. If calving dates occur shortly before the change to winter feeding, the cows concerned should be treated specially and put practically on winter rations right from the start.

* * * * *

MISCELLANEOUS NOTES

IN pursuance of its policy of encouraging and fostering intercourse between the people of the different parts of the Empire, the British National Union, in conjunction with the New Zealand Farmers' Union, is organizing a Tour of Empire Farmers to New Zealand in January next. The Party will consist of fifty British, fifteen Canadian and fifteen South African farmers. Each contingent will travel independently to New Zealand, and the combined party will commence a tour of the Dominion about February 20. An attractive programme has been arranged, covering the two Islands, and whilst the more interesting parts of the country will be visited, these will not be allowed to overshadow the chief sources of New Zealand primary production. The party will see both the best scenic resorts and the best of the agricultural districts. Opportunities will be given the party at various centres to see some of the best stock and farms, and the most successful co-operative dairies and refrigerating works. It is hoped during the tour to hold an agricultural conference at which subjects of common concern to the whole Empire will be discussed.

On the return journey, which will be *via* the Suez Canal, seven to ten days will be spent in Australia, and an interesting programme has already been arranged covering visits to Sydney and Melbourne and the more interesting parts of the intervening country.

The tour from start to finish will cover a period of approximately four months. The party will be under the leadership of Lord Bledisloe, late Parliamentary Secretary of the Ministry of Agriculture, who with Lady Bledisloe proposes to travel with the party on the s.s. "Remuera," leaving Southampton on January 17. The touring party is now in process of formation, and those to whom a tour of this character appeals should get into early touch with the Secretary of the British National Union, 218 Moorgate Station Chambers, London, E.C. 2.

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland in the three months ended June, 1929, compared with the corresponding period in 1928. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	April to June, 1929		April to June, 1928	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	185	45,878	178	33,347
Brazil	82	7,715	64	4,483
Chile	13	1,255	2	670
Denmark	3	830	0	0
Uruguay	47	7,965	32	6,340
United States of America	30	3,250	12	1,365
Australia	47	11,243	0	0
Canada	179	15,225	40	3,135
Irish Free State ..	604	12,832	449	7,375
Southern Rhodesia ..	19	1,995	6	200
Union of South Africa ..	45	2,837	2	290
Other countries ..	40	2,357	13	832
Total	1,294	113,382	798	58,037
SHEEP AND LAMBS				
Argentina	42	940	39	965
Belgium	0	0	25	207
Brazil	85	1,271	117	1,560
France	39	444	0	0
Poland	10	192	0	0
United States of America	130	1,685	0	0
Uruguay	15	205	18	800
Canada	13	195	13	55
Irish Free State ..	16	317	35	91
Union of South Africa ..	12	225	3	90
Other countries ..	33	1,039	19	342
Total	395	6,513	269	4,110
SWINE				
Argentina	1	150	1	22
Denmark	29	520	0	0
Germany	5	60	0	0
Italy	0	0	23	810
Poland	5	170	0	0
Portugal	3	60	6	112
Irish Free State ..	49	257	5	33
Union of South Africa ..	10	261	2	100
Other countries ..	12	272	4	81
Total	114	1,750	41	1,168

THE County Councils in England and Wales and also several County Borough Councils provide small holdings, varying in area from 1 to 50 acres, for sale or letting to suitable applicants. **Small Holdings** With the object of encouraging better **Competition in** cultivation and management by the **Norfolk** occupiers, several councils have organized competitions for the best managed small holdings in their areas.

A competition was recently held in the county of Norfolk and the judges have just issued their award of prizes. They reported that the majority of holdings were exceptionally well cultivated and were very clean and tidy, and the average standard of the entries was so high that it rendered the work of judging quite difficult. The stock of the competitors was very good, several of the tenants having pedigree bulls and pedigree sows. The judges reported that the cultivation, cropping and condition of the arable land was highly satisfactory in spite of the long drought; the pastures, however, had been adversely affected by the dry season, and could be improved by better manuring, harrowing, etc. The fruit-growing holdings were good, but the soft fruit had suffered much from the frost. The houses were excellently kept and tidy and were a credit to the smallholders' wives.

* * * * *

AMONG the questions considered by the Central Joint Committee of the Lord Mayor's Fund for the Relief of Distressed Mining Areas in England and Wales was that of allotments. The Interim Report of the Committee, published in July, states that the Committee were unable to deal with the matter until very late in the season this year; but the principle of giving assistance towards the proper cultivation of allotments by unemployed persons in distressed mining areas was strongly approved, and Divisional Committees were instructed to co-operate with the various County Agricultural Committees in their areas and with the Society of Friends, who had already been at work on allotment schemes in many areas, in order to render the maximum amount of assistance. Full details of the work carried out were not available at the time this Report was prepared, but it was clear that a very large number of allotments have been kept under cultivation that would otherwise have become derelict.

Assistance has been given to between 60,000 and 70,000 allotment holders, mainly in South Wales, Durham and Yorkshire, the total cost of the service being, approximately, £15,000. The assistance has taken the form of the provision, after investigation, at a reduced or nominal rate, of seeds, seed potatoes, fertilizers and, where necessary, fencing material. In some cases, arrangements were made to spread the small payments required from recipients over the summer months.

The Committee hope to provide for this work to be carried out more extensively and thoroughly next season, when more time will be available to make the necessary preliminary arrangements. In the meantime, they are satisfied not only that the expenditure incurred has provided a quantity of food where it was badly needed, but that the work involved in the cultivation of allotments has provided some occupation and incentive for a number of men, and has been a definite factor in the improvement of "morale." Enthusiastic reports have been received from the Allotment Committees operating in all the areas. The following extract from the Northumberland and Durham report may be taken as typical: "The work of the Allotments Committee, except for the closing of the accounts, is now finished and it closes on a high note. Members of the Committee have been enthusiastic in the work which has been the means of stimulating the revival of interest among allotment holders in the districts. The present condition of allotments in the distressed areas is a revelation. Many had been abandoned and the fencing destroyed. To-day, now fencing is to be seen and the ground cultivated."

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THE report of the Agricultural Meteorological Conference held at the Meteorological Office, South Kensington, S.W. 7,

**Agricultural
Meteorological
Conferences**

on September 27 and 28, 1928, has now been issued. The following papers were read at the Conference and are fully reported:—

Historical Climatology of England and Wales (O. E. P. Brooks, Meteorological Office). *The Effect of Weather at Harvest Time on the Chemical Composition of Hay* (T. W. Fagan, Welsh Plant Breeding Station). *The Effect of Weather Conditions on the Moisture Content of Cereals during Harvesting* (J. H. Blackaby, Institute of Agricultural Engineering, Oxford). *The Effect of Climatic Conditions on the Growth of Vegetables* (M. C. Vyvyan, East Malling Research Station). *The Effect of Weather in Connection with Tar Distillate Spraying* (L. N. Staniland, Long Ashton Research Station). *The Connexion between Meteorological Conditions and Pests and Diseases of Fruit* (A. H. Lees, Long Ashton). *Meteorological Conditions and Drainage from the Soil* (H. D. Welsh,

North of Scotland College of Agriculture, Professor G. W. Robinson, University College of North Wales, Professor Gerlach, Berlin). *The Relation between Air Temperature and Soil Temperatures at various Depths* (F. Tutin, Long Ashton Research Station). *Soil Temperatures in Egypt* (E. McKenzie Taylor, School of Agriculture, Cambridge). *The Influence of Meteorological Conditions on the Spread of Parasitic Worms* (Professor R. T. Leiper, Institute of Agricultural Parasitology, London). *Effect of Soil Temperature on the Behaviour and Migration of Soil Fauna* (Professor E. Handschin, University of Basle). *Soil Sterilization by Heat: Heating Glasshouse Soils by Buried Cables* (W. F. Bewley, Experimental and Research Station, Cheshunt).

A strictly limited number of copies of the report may be obtained from the Secretary, Ministry of Agriculture, 10 Whitehall Place, London, S.W. 1.

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THE main recommendations of the Royal Commission on Agriculture in India in the matter of central agricultural research and education were :—

Agricultural Research in India

(1) That a Council of Agricultural Research should be set up to promote and co-ordinate agricultural research throughout India.

(2) That the Council should be provided with a fund to be utilized in promoting agricultural and technological research throughout India by means of training research workers and encouraging, financially and otherwise, research in provincial institutions rather than by establishing research stations and engaging staff on its own account.

The Council as constituted by the Government of India will consist of two bodies, viz., a small Governing Body charged with executive functions—mainly the disbursement of the fund—and an advisory Board of Experts. The Governing Body will be composed of the Member of the Governor-General's Executive Council in charge of the portfolio of Agriculture, who will be *ex officio* chairman, the Principal Executive Officer of the Council, who will be appointed by the Government of India, and who will be *ex officio* vice-chairman, and representatives of the following bodies :—

	Representatives.
Council of State	One
Legislative Assembly	Two
Associated Chambers of Commerce of India and Ceylon	One
Federation of Indian Chambers of Commerce and Industry	One
Advisory Board	Two

In addition, the Government of each of the nine major provinces will nominate one representative, and the Governor General may appoint such other persons as he may think fit.

The Advisory Board will consist of the Vice-Chairman of the

Council, expert advisers in agriculture and in animal husbandry, the Directors of the Pusa Research Institute, the Imperial Institute of Veterinary Research, Muktesar, and the Indian Institute of Science, Bangalore, the Directors of Agriculture and a representative of the Veterinary Department in each of the nine major provinces, a representative of the minor administrations, of the Forest Research Institute, of the co-operative movement, of the Indian Tea Association and the United Planters' Association jointly, and of the Indian Central Cotton Committee, four representatives of the Indian Universities, and five non-official members with special scientific qualifications nominated by the Government of India.

As regards funds, an initial grant of Rs. 25 lakhs (£166,666½) (of which Rs. 15 lakhs (£100,000) have been provided in the budget of 1929-30), and an annual recurring grant commencing with 1930-31 of Rs. 7.25 lakhs (£48,333½), have been fixed. Of the recurring grant, Rs. 5 lakhs (£33,333½) is for the furtherance of the scientific objects of the Council and the balance is to meet the cost of the staff.

* * * * *

NEW Regulations described as Agricultural Produce (Grading and Marking) (Wheat Flour) Regulations, 1929, have been drafted under the Agricultural Produce

Wheat Flour (Grading and Marking) Act, 1928. In these Regulations grade designations and grade designation marks to indicate the quality of flour produced from wheat grown in England and Wales are prescribed in respect of flours of the following types :—

- (1) All-English (plain).
- (2) All-English (self-raising).
- (3) All-English (Yeoman).

Copies of the draft regulations are obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, or through any bookseller, price 1d., postage extra.

An article explaining the scheme will be found on page 513 of this issue.

* * * * *

THE general index number of prices of agricultural produce for July was 41 per cent. above the base years 1911-13 as compared with 40 per cent. in the

The Agricultural Index Number previous month and 45 per cent. in July, 1928. Most of the commodities used in calculating the general index number showed a decline in price during the month under review

but in a few cases, notably wheat, hay, potatoes and eggs, there was a rise in values.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1924 :—

		Percentage increase compared with the average of the corresponding month in 1911-13					
Month		1924	1925	1926	1927	1928	1929
January		60	71	58	49	45	45
February		61	69	53	45	43	44
March		57	66	49	43	45	43
April		53	59	52	43	51	46
May		57	57	50	42	54	44
June		56	53	48	41	53	40
July		53	49	48	42	45	41
August		57	54	49	42	44	—
September		61	55	55	43	44	—
October		66	53	48	40	39	—
November		66	54	48	37	41	—
December		65	54	46	38	40	—

Grain.—The main feature in this group of commodities was the sharp advance in wheat of 9d. per cwt. to an average of 10s. 4d. per cwt., the increase being attributable to the upward movement in the imported wheat market. The index number at 28 per cent. above pre-war was, however, 6 points below that of July last year. Barley and oats were little altered on the month at 9s. 9d. and 9s. 5d. respectively per cwt., but in each case the index figure was 3 points lower.

Live Stock.—Prices of live stock as a whole were rather lower than in June, although this is the customary movement for store cattle, sheep and pigs. Fat cattle were about 2s. 6d. per live cwt. cheaper, fat sheep declined by $\frac{1}{4}$ d. per lb. and fat pigs by from 2d. to 3d. per 14 lb. stone, and in all cases the index numbers were lower. Dairy cows, however, were appreciably dearer by from 15s. to 20s. per head and a rise of 3 points occurred in the index number to 33 per cent. above 1911-13. A similar rise took place in the index figures for store cattle and pigs in spite of a fall in actual prices ; in each case, however, the fall was proportionately less than in the corresponding months of the base years.

Dairy and Poultry Produce.—The average milk contract price was unaltered on the month at 57 per cent. above 1911-13, and cheese remained at 67 per cent. Butter was $1\frac{1}{2}$ d. per lb. dearer and the index number rose by 6 points to 52 per cent. above pre-war. Poultry was 6 points lower at 57 per cent.,

while eggs were considerably dearer than in June, the price rising by 3½d. per dozen and the index number by 17 points. A year ago eggs were 36 per cent. above pre-war as against 57 per cent. for the month under review.

Other Commodities.—Values for wool declined again during July, the index number falling by 5 points to 45 per cent. above the base years.

A slight increase in hay prices occurred and a further rise of 2 points brought the index number to 29 per cent. over 1911-13, or 18 points above that recorded in July, 1928, and 23 points higher than in July, 1927. The change over from old potatoes in June to new potatoes in July caused the index number for this crop to rise 30 points, but the average price of new potatoes in July was 4 per cent. below pre-war as against 37 per cent. above in the corresponding month last year. As regards fruit, cherries averaged about 35 per cent. dearer than pre-war, black currants 20 per cent., red currants 45 per cent., gooseberries 115 per cent., raspberries 85 per cent., and strawberries 125 per cent.

Index numbers of different commodities during recent months and in July, 1927 and 1928, are shown below :—

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1927 1928		1929			
	July	July	April	May	June	July
Wheat	56	34	30	25	21	28
Barley	57	37	32	34	33	30
Oats.. ..	33	58	36	31	26	23
Fat cattle ..	30	44	31	32	31	30
Fat sheep ..	45	66	53	57	59	55
Bacon pigs ..	43	41	73	81	70	64
Pork pigs ..	49	34	74	78	65	61
Dairy cows ..	25	34	29	32	30	33
Store cattle ..	26	31	18	23	22	25
Store sheep..	55	67	54	51	65	60
Store pigs ..	80	25	71	81	77	80
Eggs	31	36	45	50	40	57
Poultry	52	54	38	65	63	57
Milk	55	55	77	57	57	57
Butter	42	50	51	50	46	52
Cheese	58	81	76	81	67	67
Potatoes	61	37	15	—3*	—34*	—4*
Hay	6	11	10	22	27	29
Wool	40	78	59	59	50	45

* Decrease

IF constant reference is made in this JOURNAL to the World's Poultry Congress at the Crystal Palace next July, it is because, from the poultry-keeper's point of view, this will be the most important fixture of the coming year, and because although there are still ten months in hand, arrangements for stands and displays must be made well in advance. It needs to be emphasized that this Congress, the fourth of the series, is international in character, and that it is Great Britain's turn to play host, the Ministry of Agriculture standing in the position of convener and organizer. The British Poultry Industry has been growing rapidly in recent years, and one may confidently expect that in a few years more it will produce a much larger proportion of the eggs and poultry consumed in this country than it does at the moment. The larger economics of the industry and the best methods of up-to-date poultry-keeping, however, are not fully appreciated by all poultry-keepers—hence the desirability of holding these periodical congresses, to give experts and practitioners an opportunity to exchange views and experience.

The sessions of the Congress will be confined to meetings of delegates from all parts of the world, but poultry-keepers in general should learn much from the reports of the papers and discussions, and from a visit to the Congress Exhibition, which will include all kinds of poultry as well as most kinds of other small livestock. Exhibits will be restricted to the highest quality of stock from various parts of the world, including this country, and efforts are being made to stage also specimens of breeds not well known or rarely seen here. Some of the exhibits will be national in character, organized by committees approved by the Governments concerned, and will illustrate the development and outstanding features of the poultry industry in the respective countries. As regards British poultry, the exhibits staged at the Crystal Palace are certain to form the standard by which the home industry will be judged in other countries for many years to come.

As regards the commercial appliances section, it is sufficient to state that manufacturers are clearly recognizing the value of the Exhibition to them. More than half the available area has already been taken up, Canada and the United States having made large space reservations. Continental inquiries are now being received, and the Ministry desires to impress upon the British trade interests concerned the desirability of obtaining their space allotments at the earliest possible date.

All who participate in the Congress should benefit, and in particular British poultry-keepers and manufacturers who are prepared to make full use of the opportunity. It may be recalled that at the last Congress, held at Ottawa in 1927, some 3,000 delegates attended, and 200,000 visitors paid for admission: it will be interesting to see the corresponding figures which will be recorded at the Crystal Palace next year. Inquiries concerning the Congress and Exhibition should be sent to the Congress Secretary at the Ministry, 10, Whitehall Place, London, S.W. 1.

* * * * *

THE following interesting developments are taking place in Salop in connexion with the county scheme of agricultural education.

**Agricultural
Education in
Salop**

(a) As regards junior organized courses, it may be recalled that two years ago, in response to representations made by the Ministry of Agriculture and the Board of Education to all local education authorities in England and Wales, the Salop Agricultural Committee started a course for boys and girls aged 14 to 16, the latter age, however, not being strictly adhered to. This course was designed to stimulate or maintain the interest of these young people in an agricultural career. An account of this experiment was given in the JOURNAL for May, 1929 (p. 115), and for the purposes of this note it will be sufficient to recapitulate the following brief particulars of the original courses.

The first course was started at Pontesbury in October, 1927, and having regard to the results obtained the Committee felt justified in continuing the experiment at two further centres—Hodnet and Shifnal—in 1928. The boys and girls shared the instruction in such subjects as were suitable to both sexes, *viz.*, English, rural lore, elementary agriculture and horticulture, poultry management and agricultural mathematics. The boys then devoted their attention to woodwork—a popular subject, particular attention being paid to the making of poultry appliances—elementary farriery and the care of implements, whilst the girls were engaged in cookery and domestic science.

The Committee have now decided, with the Ministry's consent and assistance, to extend these courses to all parts of the county. Twenty-seven centres have been selected, at nine of which courses will be commenced in the first full winter session (October to March). In the following year,

second-year courses will be held at these nine centres, whilst first-year courses will commence at nine other centres. In the third year, no instruction will be given at the first nine centres, but nine centres will have second-year courses and the last nine first-year courses. In this way the Committee hope to catch as many as possible of the 4,000 children who, it is estimated, will leave the various schools in the centres over the period of three years.

The Committee propose to engage two instructors—agricultural and horticultural—to assist the agricultural education staff in running these courses, and help will also be rendered by teachers at the elementary schools.

A fee of 2s. 6d. is to be charged for each course; this is returnable if 75 per cent. of the possible attendances have been made. Certificates will be issued to qualifying students, and prizes of books or instruments will be awarded to the best students at each centre. It is proposed to hold a summer meeting of an educational nature at some suitable centre.

(b) Farmhouse courses for girls have also been started. A new wing was recently added to the Shropshire Technical School for Girls at Radbrook, with the intention that it should be utilized solely for teaching domestic science. As a result, however, of the recommendations contained in the Report of Lady Denman's Committee on "The Practical Education of Women for Rural Life," the Governors of the School, after consultation with headmistresses in the county, decided to revise their scheme and include a farmhouse management course. The course will consist of three terms, and instruction will be given in gardening, beekeeping, poultry keeping, dairy work and domestic subjects, the aim being to fit girls for home life on farms and smallholdings or for salaried posts as assistants in dairy and poultry work. Scholarships are being established to assist students to attend this course; four resident scholarships at £30 each and one non-resident scholarship of £20, tenable for twelve months, will be offered annually, and the candidates will be selected by the Salop Agricultural Education Sub-Committee.

The local authority have agreed to aid the cost of furnishing, equipping and maintaining the new wing and will provide the necessary funds for the scholarships. This expenditure will be aided by the Ministry under its Educational Grant Regulations.

The lack of facilities for the teaching of rural domestic economy has been criticised in the past, and the establish-

ment of the Radbrook course may be regarded as a pioneer effort to remedy the deficiency and to give effect to one of the chief recommendations in the Denman Report.

The authorities in Salop are to be commended for their efforts to advance the standard of knowledge amongst country boys and girls, and the progress of their schemes, will doubtless be watched with interest by other local authorities.

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**Import of Eggs
into Holland**

A LAW of May 31, 1929, prohibits the importation, for retention inland or for export, of hens' or ducks' eggs which are not indelibly marked with the name of the country of origin.

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**THE Ministry's
Marketing
Demonstrations
at Agricultural
Shows**

summer programme of marketing demonstrations concluded with the Royal Welsh Show at Cardiff, August 7-9, where the sections covering pigs, poultry, cattle, cereals, fruit, potatoes and the National Mark were staged.

A demonstration of egg grading was given at the Whitechurch (Salop) Agricultural Show on July 24, in co-operation with a local registered packer, Mr. P. E. White, of the "Eggflo" Farms, Market Drayton. A Bramall battery grader was used, and the grading and packing of eggs was demonstrated continuously throughout the day. Keen interest in the process was shown by the numerous visitors to the stand.

A similar demonstration, together with the section relating to pigs and pig products, will be staged at the Buckingham County Show at Waddesdon Manor, near Aylesbury, on September 5.

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ACTIVE operations are about to begin upon an extensive scheme for the improvement of the outfall of the River Welland by carrying the training walls out to deep

**River Welland
Outfall Works**

water, and incidentally effecting a junction with the already trained channel of the neighbouring River Witham.

The scheme is to be assisted to the extent of 50 per cent. of the final net cost by a grant from the funds placed at the disposal of the Ministry of Agriculture and Fisheries for the assistance of comprehensive land drainage schemes designed to confer a wide benefit on agricultural land. The total estimated cost of the scheme is £190,000, and it is calculated

to provide employment for a considerable number of men for at least five years.

The scheme was submitted to and approved by the Ministry a considerable time ago, but it is only recently that the consent of the Board of Trade, which is necessary in respect of such works, has been obtained, owing to objections to the scheme having been lodged with the Department, and only withdrawn after protracted negotiations.

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In a recent issue of *Science* (U.S.A.) (June 7, 1929, p. 606) appeared a short note dealing with the effect of X-rays on potato tubers for seed. The note is a

**The Effect of
X-Rays on
Potato Tubers
for "Seed"**

contribution from Mr. Howard B. Sprague, of the College of Agriculture, Rutgers University, and Mr. Maurice Lenz of the Montefiore Hospital Radium Clinic, New York City. They refer to previous work*

and go on to state:—

"In view of the recent article by Johnson on increased tuberization of potatoes caused by X-rays, it may be worth while to report results of a similar experiment in which the findings were contrary to those indicated above. Certified 'seed' of both Irish Cobbler and Green Mountain varieties were used, and two dosages of X-rays were employed.

"One half of each tuber was irradiated and the other half untreated as a control. One lot of half tubers was irradiated for ten minutes and a second lot for five minutes, using a Waite and Bartlett machine, 200 K.V., 4 N.A., distance 50 cm., field 20×20, filter 1 mm. al., i.e., in human, erythema dosage 10-min. 2 E.D., 5-min. 1 E.D. The tubers were placed with the cut side down and sprouts up when irradiated. Sprouts were just beginning to develop at the time of exposure and the tubers were planted in the field on the following day. Each 'seed' piece was cut to a weight of thirty grams using the 'bud' end, and the pieces were spaced nine inches in the row. The corresponding treated and untreated pieces were planted in adjoining rows thirty-two inches apart. The soil used was Sassafras sandy loam of good fertility, and a 5-8-7 fertilizer was used at the rate of 1,000 pounds per acre.

* Czapek, "Biochemie der Pflanzen," 11, 411, 1920.

Journal Series paper of the New Jersey Agricultural Experiment Station, Department of Agronomy.

E. L. Johnson, "Tuberization of Potatoes Increased by X-rays," *Science*, 68: 231, 1928.

Ordinary tillage was practiced and the plants were dusted periodically with lead arsenate to control the potato beetle. The crop was harvested by hills after the vines were dead, and each tuber was weighed separately.

"Plants from the lot of tubers receiving the ten-minute exposure produced only 84.4 per cent. as many tubers of all sizes as the untreated controls, and only 89.6 per cent. as many tubers weighing over forty-five grams each. Although the total weight of all tubers was reduced 6.0 per cent. by the treatment, the total weight of tubers weighing over forty-five grams was increased 6.1 per cent. The average weight per tuber of marketable stock (over forty-five grams per tuber) was 81.6 grams for the lot irradiated ten minutes, as compared with 68.9 grams for the untreated lot.

"Plants from the lot of tubers irradiated five minutes produced 104.7 per cent. as many tubers of all sizes as the controls; and 105.1 per cent. as many tubers weighing over forty-five grams each. The total weight of all tubers was increased 3.0 per cent. by the treatment, and the total weight of marketable tubers was increased 3.8 per cent. The average weight per tuber of marketable stock was 74.7 grams for the lot treated five minutes, as compared with 73.7 grams for the corresponding untreated lot.

"The ten-minute irradiation caused the first leaves of the plants to assume a peculiar shape. The leaf tips appeared to have been injured and the blade was pinched-in as it approached these lesions. The margins of the leaf curled downwards, and the leaf in general seemed to be more glossy than normal leaves. Subsequent leaves of these plants were normal. After formation of normal leaves the plants were vigorous, and remained green several days later than untreated plants at the time of maturity. No striking abnormalities resulting from irradiation were noted in the harvested tubers. Irradiation for five minutes produced no apparent modification of plants or tubers.

"These results indicate that strong dosages which cause definite lesions on leaves may also reduce the number of tubers formed; but such tubers may attain a greater size, so that yields of marketable stock are not lowered. It seems likely that still stronger dosages may reduce tuberization still further, and perhaps the yield of marketable stock as well. Further experiments of this nature are being planned."

Wages Act : High Court Decision.—On July 16 a Divisional Court, consisting of the Lord Chief Justice, Mr. Justice Avory and Mr. Justice Branson, heard the Ministry's appeal against the decision of the Pickering (Yorkshire) Magistrates in a case which was brought before them on February 4, 1929. The appeal was made in order to obtain the decision of the High Court on the question whether, in the case of a yearly hiring, the Agricultural Wages (Regulation) Act overrides the common law principle under which when a worker unlawfully breaks his contract he is entitled to no wages. That is to say, the Ministry sought the opinion of the Appeal Court on the question whether, in such circumstances (*i.e.*, where it is the worker who breaks the contract), he should be paid the minimum rates applicable to him for such part of the period of his contract as he actually worked. The Ministry's appeal was dismissed.

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Enforcement of Minimum Rates of Wages.—During the month ending August 15, legal proceedings were instituted against 10 employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages			No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	d.	
Chester ..	Lymn ..	10	0	0	7	8	0	28	10	0	1
Derby ..	Bakewell ..	2	0	0	—	—	—	9	16	0	2
" ..	" ..	—	—	—	—	—	—	—	—	—	1
Dorset ..	Dorchester ..	2	0	0	—	—	—	17	10	0	1
" ..	Wimborne ..	10	0	0	2	2	0	19	14	1	6
Durham ..	Gateshead ..	0	12	6	—	—	—	20	11	0	2
Gloucester	Wheatenhurst	*	—	—	0	4	0	4	1	0	1
Lancaster.	Padiham ..	1	0	0	—	—	—	15	18	3	1
" ..	Wigan ..	2	0	0	—	—	—	†	—	—	1
Denbigh..	Ruthin ..	0	10	0	1	1	0	22	10	0	2
		£28	2	6	£10	15	0	£138	10	4	18

* Dismissed under Probation of Offenders Act.

† Amount of arrears to be agreed.

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Foot-and-Mouth Disease.—The country continues free from outbreaks of foot-and-mouth disease, no case having being confirmed since that at Littleton, Winchester, Hants, on June 8.

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APPOINTMENTS

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND AND WALES.

Agricultural Department, University College of Wales, Aberystwyth

Mr. A. W. Ashby, M.A., Lecturer in Agricultural Economics, has been elected Professor of that subject.

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Cornwall : Mr. H. Carveth has been appointed Assistant Instructor in Poultry-keeping and Manager of Egg-laying Trials.

Herefordshire : Miss W. C. Davis, N.D.P., has been appointed Instructress in Poultry-keeping.

Lincolnshire (Holland) : Mr. J. Wood, A.R.C.Sc., D.I.C., has been appointed Agricultural Entomologist, *vice* Mr. E. E. Edwards, M.Sc., B.Sc.

Mr. F. W. Handley, B.Sc., Ph.D., has been appointed Assistant Agricultural Chemist.

Warwickshire : Mr. G. H. Nash, N.D.A., has been appointed Horticultural Adviser, *vice* Mr. H. Dunkin, N.D.H.

Yorkshire (Agricultural Department, University of Leeds) : Miss D. M. Turner, B.Sc., has been appointed Demonstrator in Agricultural Botany, *vice* Mr. D. Green, M.Sc.

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NOTICES OF BOOKS

Life in Inland Waters.—By Kathleen E. Carpenter. Pp. xviii + 267. 116 illustrations. (London : Sidgwick & Jackson, Ltd. 1929. Price 12s. net.)

This book is a welcome addition to our literature as it deals with a phase of nature study that has been somewhat neglected in the past. Dr. Carpenter's researches into this branch of natural science have been painstaking and extensive ; the material has been wisely chosen, and the book has the added merit of being written in an attractive and easily understood manner. The author succeeds in making generally interesting a work which, had scientific phraseology and nomenclature been too rigidly retained, might possibly have failed of its object, which is, doubtless, to attract the layman and the amateur naturalist as well as the trained scientist.

The information upon the habits and life histories of the various creatures is adequate and reliable, and the arrangement of inland aquatic "life" into still water, running water and sluggish water groups is both scientifically sound and convenient for the reader. Of particular interest and value are the chapters on the life of inland waters in relation to the physical properties of the ambient medium ; the distribution and dispersal of freshwater animals, and the biology of inland waters in relation to human life. One could wish that this last phase of the subject had been extended and elaborated.

If there are faults in the work, it might be suggested that the aquatic flora has been given less attention than might have been expected, and that the various species of freshwater fish have also received scant notice. As to the latter, however, it might, justifiably, be contended that adequate treatment of the subject would necessitate a separate volume. Such minor criticisms in no way detract from the general value of the book, which can be read with pleasure and profit by any student of nature. The illustrations are numerous and, for the most part, very good ; and the book, which is well produced, has the benefit of a foreword by Professor Julian Huxley.

* * * * *

Livestock Husbandry on Range and Pasture.—By Arthur W. Sampson. Pp. xxi + 411. 116 illustrations. (London : Chapman and Hall, Ltd. New York : John Wiley & Sons. 1928. Price 22s. 6d. net.)

This book is dedicated to the Livestock Associations of America and deals more particularly with stockbreeding conditions and practice in the United States. It forms a companion volume to the author's

earlier works, "Range and Pasture Management" and "Native American Forage Plants," the first of which deals with methods of revegetating pasture lands, and the second with the comparative value of the native and introduced species of forage plants. The present volume, completing the trilogy, treats of the husbandry of the different kinds of livestock on range and pasture, and of the more important problems of economics concerned in such production. This thesis is developed under four main headings. "Range History and Livestock Improvement" surveys the introduction and population of livestock on the American continent, outlining the probable trend of its future meat supply and the most effective means of improving the quality of domestic foraging animals. "Pasture Husbandry of Sheep and Goats" and "Pasture Husbandry of Beef Cattle" are studies based on practical tests of approved methods of handling the respective classes of livestock with respect to seasons of pasture use to ensure the maximum amount of nutritious forage. These sections also treat of breeding questions, the adaptability of leading breeds to both range and pasture, and the control of the more common diseases. The fourth section, "Economics of Pasture Livestock," discusses the cost of raising and rearing livestock, and presents a system of cost-keeping adaptable to the individual stockkeeper's conditions. Part of this last section deals with methods of control for various native animals that destroy livestock and rodents that destroy pasture forage; while a final chapter discusses the possibilities of reindeer breeding as a range industry in the far north. With an eye to probable use as a textbook, each chapter in the work is rounded off with a set of examination questions and a bibliography--the references, however, being exclusively to American works.

While the book contains much that will be of interest to British stockbreeders, and to those who wish to compare British and American methods, it will be realized that the differing conditions necessarily limit the utility of the work for students in this country.

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Ancient Agriculture. (L'Agriculture dans l'Antiquité, d'après les Géorgiques de Virgile).—By Raymond Billiard. Pp. 537. With 6 full-page plates and 87 text illustrations. (Paris: E. de Boccard. 1928. Price 100 francs.)

It is a pity that English students of ancient agriculture should have to go abroad for literature. Adam Dickson's monumental work, *The Husbandry of the Ancients*, posthumously published in 1788, is now scarce, and it is really a pity that no publisher is enterprising enough to have it competently re-edited and reprinted. Meanwhile, M. Billiard may be accepted as a dependable and trustworthy guide. Taking Virgil as his text, he leads us through the various branches of agriculture—arable farming, the vine (he published, in 1913, a useful work on ancient vine-growing), the olive, stock-keeping and bees. Chapters on the fauna and flora of the Georgics complete the book. Not only is copious and well-documented information given as to ancient practice, but interesting parallels are drawn from modern French agricultural authorities. The illustrations are good—some of the full-page plates are rather indistinct, but this may be the fault of the fourth-century originals. The book is sumptuously printed; the reader who works, pencil in hand, will find usefully wide margins to the pages. The only adverse criticism to offer is that the book gives the impression of having been hurried through the press. Cohesion between the main text and the numerous foot-notes is occasionally lacking; the services of an independent proof-reader, fully familiar with the subject, would have made a really good book much better.

One-Man Poultry Farming. By A. H. Capper. Pp. 55. (London : City and South London Printing and Publishing Co., Ltd. Price 1s. net.)

This little volume is a reprint of a series of useful articles published in *Eggs* in 1923 and since revised and issued in permanent form. Mr. Capper covers in small compass the whole gamut of poultry farming, treating the subject from the point of view of a one-man concern. For its size, it is certainly one of the best introductions to the subject which could be placed in the hands of a beginner. The lay-out of a small plant is discussed without dogmatizing, and the suggestions offered are practical. Mr. Capper advocates organizing the stock in units of not more than 100 birds, and for housing the birds he recommends a "three house unit," i.e. three houses measuring 30 ft. by 15 ft., which become in turn brooder house, house for laying pullets, and house for breeding stock. The cycle is thus completed in three years. Other chapters deal with incubation and rearing, feeding, and not least the business side. The total stock which Mr. Capper has in mind for "one-man poultry farming" is 400, the capital outlay for which he puts at £500 for stock and materials, excluding rent. To this figure must be added also for practical purposes an allowance for personal expenses until an income from the poultry is secured. Mr. Capper appends a profit and loss account, based on his own experience over a number of years, which shows a net profit of £240 on a venture of this kind—probably a somewhat higher figure than many "one-man poultry farmers" could realize.

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Four Years' Farming in East Anglia, 1923-1927. By R. McG. Carslaw, M.A. Foreword by J. A. Venn, M.A., University of Cambridge, Department of Agriculture : Farm Economics Branch, Report No. 12. Pp. x+125. (Cambridge : W. Heffer and Sons, Ltd. 1929. Price 3s. paper covers ; 5s. cloth.)

The problems of agriculture have been approached from many angles ; at different times various types of farming or particular crops have been regarded as the one necessity for making agriculture a prosperous integer in the national economy. At one time, especially in the 18th century, wheat-growing was considered to be the one essential for prosperity, but even so, in the latter years of that century, cattle improvement began to compete with arable farming. Davy's discoveries in the early years of the 19th century led to the improvements by means of artificial manures ; but there has always been a large measure of uncertainty about the effect of the various elements of a mixed farm in the ultimate prosperity of that farm, and empiric experience has been the only guide to financially successful farming in the past.

The modern fashion is to be more definite ; less reliance is placed upon visual observation and more definite mathematical data are usually demanded before conclusions are reached. The bi-annual reports, which have been issued during the past four years by the Farm Economics Branch of the University of Cambridge, taken in conjunction with the reports of other provincial advisory economic centres, have done something to provide us with this type of accurate information upon which to judge the results of the different operations, the value of certain crops in specific conditions of the world market, and so on. The results of the Cambridge investigations have now been amalgamated and concentrated in the volume at present under review. This volume attempts to give a picture of the results of a four years' rotation. It deals with every branch of farming carried out in the eastern counties, and a careful analysis of all the mass of

figures collected is made. By this means the economic results of the four years' work are depicted, and a picture of the work of the farm, as well as its effect upon the life of the people on that farm, both farmers and labourers, is to some extent outlined.

It has been said that we read too little history in these days. As an antithesis to this remark it has also been said we have too few illiterate men amongst our population. The present investigation is, of course, history, although it is extremely recent history in so far as it is a story of the past four years' work. It gives us some idea of the progress made, and the kind of development that has been taking place, but in such a limited period as it covers, material for definite conclusions can hardly be obtained, especially in the fluctuating conditions in which we have been living. At the same time, we have here, perhaps, the most comprehensive collection of detailed financial results of farming which has yet been published. When the investigations have been continued during the period that would normally be covered by a fairly long succession of rotations, material will have been obtained which will, at least, be a guide to the East Anglian farmers as to the best manner of operating their farms to enable them to obtain the most advantageous financial results. Moreover, such a collection of data will be of enormous value in the future, since it will enable us not only to deduce the details of the life of the agricultural community, but will provide material of the same type as that being used so successfully in modern research by historians of the mediæval period.

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SELECTED CONTENTS OF PERIODICALS

Field Crops

A Note on the Sampling of Sugar Beet. *S. T. Johnson.* (Jour. Agric. Sci., xix, 2 (April, 1929), pp. 311-314.) [63.3433.]

Sugar Beet: Position and Outlook. Rt. Hon. *E. G. Pretyma.* (Jour. Roy. Agric. Soc. Eng., Vol. 89 (1928), pp. 1-9.) [63.3433.]

Experiments with Soya Beans in Shropshire. *D. H. Robinson.* (Agric. Prog., vi (1929), pp. 60-64.) [63.321.]

The Influence of the Number of Nodule Bacteria Applied to the Seed upon Nodule Formation in Legumes. *H. G. Thornton.* (Jour. Agric. Sci., xix, 2 (April, 1929), pp. 373-381.) [576.83.]

The Cultivation of Willows on Sewage Farms. *H. P. Hutchinson.* (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. III (1928-29), pp. 229-236.) [63.3412.]

Horticulture

The Principles underlying the Planting of Fruit Trees. *R. T. Pearl.* (Jour. Roy. Agric. Soc. Eng., Vol. 89 (1928), pp. 87-97.) [63.41; 63.41-195.]

Factors Governing Fruit Bud Formation: Some Observations upon the Leaf Area of Spurs on Biennially Bearing Apple Trees. *T. Swarbrick.* (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. III (1928-29), pp. 158-174.) [63.41.]

Scottish Fruit Survey, 1926 to 1928. (Scottish Jour. Agric., xii, 2 (April, 1929), pp. 205-211.) [63.41 (41).]

An Investigation of the Changes which take place in the Chemical Composition of Pears stored at Different Temperatures, with Special Reference to the Pectic Changes. *A. M. Emmett.* (Ann. Bot., XLIII, 170 (April, 1929), pp. 269-308.) [543.1; 63.41; 664.85.]

Plant Pests and Diseases and Remedies

List of Common Names of British Plant Diseases. (Compiled by the Plant Pathology Sub-Committee of the British Mycological

- Society.) (Trans. Brit. Myc. Soc., xiv, 1 and 2 (March 11, 1929) pp. 140-177.) [63.2; 63.23; 63.24.]
- A Preliminary Note on the Development of Secondary Symptoms of Potato Leaf-Roll in the year of infection. *T. Whitehead* and *J. F. Currie*. (Scottish Jour. Agric., xii, 2 (April, 1929), pp. 214-215.) [63.23.]
- "Sprain" of Potatoes. *S. Burr*. (Agric. Prog., vi (1929), pp. 64-66.)
- A Preliminary Note on the Control of Black Currant Leaf Spot (*Pseudopeziza ribis*). *R. W. Marsh* and *J. G. Maynard*. (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. iii (1928-29), pp. 196-198+2 pl.) [63.24.]
- Spraying Trials against Apple Scab at Long Ashton in 1928. *J. G. Maynard* and *R. W. Marsh*. (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. iii (1928-29), pp. 183-195.) [63.24.]
- The Control of the American Gooseberry in Northern Ireland. *A. E. Muskett* and *E. Turner*. (Agric. Prog., vi (1929), pp. 67-68.) [63.24.]
- "Dry-Rot" of Swedes. *T. Whitehead* and *W. A. P. Jones*. (Welsh Jour. Agric., v (1929), pp. 159-175.) [63.24.]
- Observations on the Control of Weevils of the Genus *Apion* attacking Red Clover. *J. R. W. Jenkins*. (Welsh Jour. Agric., v (1929), pp. 176-186.) [63.27.]
- Experiments on the Relation of Strawberry Eelworm (*Aphelenchus fragariae*) to "Red Plant" and "Cauliflower" Disease of Strawberries. (Progress Report.) *L. N. Staniland* and *T. Swarbrick*. (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. iii (1928-29), pp. 198-209.) [63.27.]
- A Review of the Present Position with regard to Soil Insecticides. *H. W. Miles*. (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. iii (1928-29), pp. 15-38+3 pl.) [63.295.]
- The Uses of Naphthalene for the Control of Certain Pests of Market Gardens. *L. N. Staniland* and *C. L. Walton*. (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. iii (1928-29), pp. 209-211.) [63.295.]
- Pyrethrin I and II: Their Insecticidal Value and Estimation in Pyrethrum (*Chrysanthemum cinerariifolium*), I. *F. Tattersfield*, *R. P. Hobson* and *C. T. Gimmingham*. (Jour. Agric. Sci., xix, 2 (April, 1929), pp. 266-296.) [63.295.]
- The Fungicidal Action of Ultra-Violet Radiation. *H. R. Fulton* and *W. W. Coblenz*. (Jour. Agric. Res. 38, 3 (Feb. 1, 1929), pp. 159-168.) [63.295.]

Live Stock and Feeding

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- The Marketing of Milk in relation to the Incidence of Production.** *A. E. Magee.* (Jour. Farmers' Club, 1929, Part 3 (April), pp. 41-59.) [63.716.]
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- Estimation of Yeasts and Moulds in Butter: Influence of the Hydrogen-ion Concentration of the Medium on the Mould and Yeast Counts of Butter.** *P. Clerkin.* (Jour. Irish Dept. Agric. xxviii (1929), 2pp. 199-207.) [576.8 : 7 ; 63.721.]
- The Development of Acidity in Cheddar Cheese.** *Mary C. Taylor.* (Agric. Prog., vi (1929), pp. 80-82.) [63.73 ; 63.736.]
- The Grading of Dairy Produce.** *T. C. Goodwin.* (Jour. Brit. Dairy Farmers' Assoc., xli (1929), pp. 80-83.) [63.70 : 38.]
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- The Manufacture of Ice Cream in a Small Commercial Dairy.** *R. W. Champion.* (Jour. Brit. Dairy Farmers' Assoc., xli (1929), pp. 92-99.) [63.715.]
- The Organization, Management and Cost of Production of Farmers' Co-operative Dairies.** *L. J. Lord.* (Jour. Brit. Dairy Farmers' Assoc., xli (1929), pp. 100-110.) [334.6 ; 63.714 ; 63.718.]
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Poultry

- The Relative Values of Various Grain Mixtures for Chicks.** *H. F. Newbigin and R. G. Linton.* (Scottish Jour. Agric., xii, 2 (April, 1929), pp. 164-168.) [63.651 : 043.]
- An Interesting Co-operative Egg-Collecting Station.** *A. G. Ruston.* (Scottish Jour. Agric., xii, 2 (April, 1929), pp. 139-149.) [63.74 ; 63.741.]
- Marketing of Eggs in Northern Ireland.** *J. Adams.* (Agric. Prog., vi (1929), pp. 105-111.) [63.741.]

Veterinary Science

- Notes on the Calmette-Guerin Method of Tuberculosis Prevention.** *N. Bisset.* (Welsh Jour. Agric., v (1929), pp. 187-189.) [614.54.]
- The Position with regard to Liver Fluke in South Wales.** *H. W. Thompson.* (Welsh Jour. Agric., v (1929), pp. 190-197.) [619.3.]
- Insect Pests: IV, Acarina Injurious to Stock.** *R. Stewart MacDougall.* (Scottish Jour. Agric., xii, 2 (April, 1929), pp. 155-164.) [59.169.]

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NOTES FOR THE MONTH

A DETAILED and fully illustrated Report on the Marketing of Cattle and Beef in England and Wales has just been issued by the Ministry*. It is pointed out in the **The Marketing of Cattle and Beef in England and Wales** introduction that the cattle industry is, at the present time, the most important branch of English agriculture, the value of the annual beef output in England and Wales—over £31,000,000 in 1925—being second only to that of liquid milk. The Report embodies the result of investigations into the marketing of this output.

As in the case of the other reports on marketing in this series, a wide field is covered. The early chapters are concerned with supplies, the raw material of the beef industry, and demand and prices. These chapters show the decline in the percentage of home-killed beef supplies as compared with imported, and the increase in the supplies of cow beef due to the increase in dairying. The characteristics of various types of cattle, from the beef point of view, are considered, and an important section deals with the nature and significance of growth. The prevalent demand for medium to light-weight cattle is emphasized. In the chapter on prices, the trend and seasonal variations in the prices of store cattle, fat cattle and beef are analysed, and consideration is given to the difficult subject of the relation of cattle prices to wholesale and retail beef prices.

The flow of cattle supplies is then examined and a general outline is given of the principal movements of store and fat stock. The functions of the dealer are described and a section follows on the grading of store and fat cattle. The introduction of a standard system of grading store cattle based on quality and weight is recommended.

In regard to transportation, it is shown that, with few exceptions, the cost of transport for live cattle is less than

* Ministry of Agriculture and Fisheries, Economic Series No. 20 : His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price 6d. net, post free, 9d.

that for dead meat on the basis of existing rates. The costs of transport, it is pointed out, have discouraged the fattening of cattle in many districts. The increasing use of road transport both for live animals and carcasses is discussed.

The existing methods of sale are held to be as good as any others while the trade is organized on its present lines. As regards stores, the case for co-operative buying and selling agencies is examined. The difficulties which such agencies would have to encounter are pointed out, but it is considered that these difficulties might not be insuperable if progress were made in the grading of store cattle. As regards fat cattle, the changing conditions of meat distribution in the large consuming centres may make some change from the existing system imperative; various possibilities are discussed and it is suggested that a system of co-operative selling agencies may be the best solution. Such a system would, it is held, be preferable to co-operative abattoirs in producing districts. These could hardly work economically on account of the seasonal irregularity of supplies. They would at any rate be at a great disadvantage as compared with public abattoirs in towns, which are bound to come and are destined to play a part of far-reaching importance in the trade.

An important chapter deals with the modernization of the abattoir system of the country. It is considered that many mistakes have been made in the past in the design of and methods of working in public abattoirs. These mistakes have caused the retail trade to dislike the central slaughtering system, yet there can be hardly any doubt that, as regards urban areas, central slaughtering under a proper system is the only way in which maximum economies can be effected and the general supply of home-killed beef can be brought to the consuming public in the best possible condition. A meat works plan is advocated for adoption in public abattoirs. Such a plan would enable retailers to buy their own cattle, if they so desired, and it would eliminate waste in many directions.

The succeeding section of the Report deals with the wholesale and retail meat trade, and has a suggestive chapter on the grading and marking of beef which will attract widespread attention. The various methods of grading used by importers of beef from Australasia and South America are described, as well as the practice in the United States. The case for grading and marking home-killed beef in urban areas in this country is argued. It is held that a system of grading and marking would be of service to producer, distributor and consumer. Refer-

ence is made to the proposed experiment in grading and marking which is to be started this autumn in London and a provincial centre.

Other chapters describe the trades in offals and by-products and deal with the question of condemned carcasses and insurance. The main points of the Report are summed up in the concluding observations. It is there pointed out that the Report is not intended as a text-book on the meat trade, but "is to be regarded as an attempt to draw out a line of policy for study and examination by all interested in the production and distribution of British beef." Throughout, the difficulties of the farmer are not minimized, but it is believed that with the assistance of the various interests concerned, all of which have shown a strong desire to help the home industry in any way possible, much might be done to encourage the production of British beef, which still holds pride of place in the British market.

With the aid of funds placed at the disposal of the Ministry by the Empire Marketing Board, this interesting and timely Report is issued at the nominal price of 6d., which should ensure for it a wide circulation.

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THE Institute for Research in Agricultural Engineering, Oxford, following its trials of a Canadian-built combine harvester during the season of 1928, recently carried out trials of three different types of combine harvester, including a model by Messrs. Clayton and Shuttleworth, Ltd., Lincoln, and Massey-Harris and Holt types. The trials were held at three centres in Hampshire, Lincolnshire and Wiltshire, where crops of wheat, barley and oats were satisfactorily cut and thrashed. In some cases the crops were first cut and windrowed, and subsequently picked up and thrashed and bagged by the machine; in other cases the cutting, thrashing and bagging were done in one operation, one field of 16 acres of wheat being thus dealt with in one afternoon (six hours' work). The condition of the grain obtained was good, but in certain cases it was considered desirable to pass the grain through a specially constructed drying plant before storing. It is indeed probable that, if the combine harvester is introduced into British practice, it will be necessary for drying plant to be available during a normal season, but further experience is necessary before it can be

said definitely under what conditions the drying of the grain will be necessary.

The trials aroused widespread interest, and, as must necessarily occur with any proposed innovation in farming practice, considerable controversy. This centred mainly on such points as the condition of the straw, the moisture content of the thrashed grain and the loss of grain ; and in general the cost of the operation. It is expected that these and other controversial points will be fully dealt with in the report on the trials which will in due course be published by the Oxford Institute.

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NATIONAL Rat Week, which is now a recognized institution in this country, has been fixed this year for the week commencing Monday, November 4, and

**National Rat
Week, 1929**

the Ministry has addressed a circular letter to all the local authorities who exercise powers and duties under the Rats and Mice (Destruction) Act, 1919, urging upon them the desirability of making a special effort during that week to secure concerted action for the destruction of these pests.

The immense loss caused by the depredations of rats, both directly in the destruction of foodstuffs and material, and indirectly as agents and carriers of disease, is becoming generally recognized throughout the country. The experience of the Ministry shows, however, that although many local authorities are doing their utmost to carry out the provisions of the Act, and that leading Health Societies are taking a keen interest in the problem, there are still some local authorities who do not appear to be sufficiently alive to the importance of rat destruction. Systematic action on the part of all occupiers of land and buildings and of local authorities and those who control large estates, factories, industrial premises, etc., is the only means by which a marked improvement in the position can be hoped for.

The Ministry's circular letter contains a number of suggestions for concerted action and methods of procedure specially suitable for application under various conditions, and in order to assist local authorities in the campaign, the Ministry is prepared to lend them copies of its cinematograph film entitled "The Rat Menace" and a set of lantern slides, together with a lecture to be read in conjunction therewith.

The local authorities have also been supplied with copies of a pamphlet which gives the names of firms prepared to

supply rat destructive preparations and materials, and also contains some simple suggestions for their application. This pamphlet is suitable for distribution among the general public and the Ministry accordingly suggests that they should be copied for this purpose. Useful suggestions and advice are to be found in the Ministry's Leaflet No. 244 on the destruction of rats ; single copies are supplied free of charge on application, while additional copies can be obtained at the rate of 1d. each, 9d. per dozen, or 4s. per hundred, post free.

A more comprehensive publication, *Rats and How to Exterminate Them* (Miscellaneous Publication No. 51) may be obtained from the Ministry at the price of 3d., post free. This publication covers 18 pages and contains 9 illustrations.

The Ministry is prepared at any time to give all the assistance and advice in its power in any case of rat infestation which presents features of unusual difficulty.

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DURING the past few years, increasing interest has become centred in a somewhat exceptional grass, to which the name Rice Grass or Cord Grass has been given.

Rice Grass The importance of this grass (*Spartina Townsendii*) lies in the fact that through its extraordinarily extensive and deep-seated roots it is capable of assisting the reclamation of unoccupied maritime muds as well as settled saltings. There is the further interest that it will minimize foreshore erosion and thus afford protection to sea walls. Rice Grass would appear, also, to be of a type suitable for fodder for farm stock, whether it be in the green state or in the form of hay. The Ministry feels that it is desirable to reprint for general use three articles which recently appeared in this JOURNAL, these articles providing a reasonably full account of the plant and its possibilities. They have accordingly been reprinted, duly revised, as one of the Ministry's series of "Miscellaneous Publications."* Part I was contributed by F. W. Oliver, D.Sc., LL.D., F.R.S., Quain Professor of Botany, University College, London ; Part II by James Bryce, B.Sc., of the East Anglian Institute of Agriculture, Chelmsford ; and Part III by Frank Knowles, F.I.C., of the same Institute.

Apart from a grant of £40 made by the Ministry in 1927-28 to the East Anglian Institute of Agriculture, Chelmsford, for the purpose of carrying out a feeding trial, the Empire Market-

*Miscellaneous Publications, No. 66, obtainable from the Ministry, 10 Whitehall Place, London, S.W.1, price 8d., post free.

ing Board has made a special grant of £220 to the same Institute for the purposes of an investigation into the use of rice grass in relation to the protection of sea defences.

In thus calling attention to the possibilities of *Spartina Townsendii* the Ministry desires to emphasize the fact that the introduction of this plant to an estuary is bound to reduce the quantity of tidal water flowing into and out of the estuary. In certain circumstances this might adversely affect navigation and land drainage interests. It is, therefore, of the greatest importance that the closest possible attention should be given to all local circumstances when any question of planting *Spartina* may be brought up.

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THIS Report* contains an account of the international work which has been done in recent years with the object of assisting the efforts of individual countries in reducing the prevalence of animal plagues, including a reference to the establishment at Paris of the International Office of Contagious Diseases of Animals, its objects and activities, and also to the inquiries as to veterinary regulations which are being made by the Economic Committee of the League of Nations. The occasion was appropriate for the inclusion of a description of the organization for dealing with contagious diseases of animals in Great Britain.

**Diseases of
Animals Acts :
Annual Report
for 1928**

In addition to the usual statement as to the outbreaks of foot-and-mouth disease during the year, the Report contains a complete résumé of the policy and procedure adopted in Great Britain for dealing with that disease as revised by the Foot-and-Mouth Disease Order of 1928.

The establishment early in the year of a Quarantine Station at the East India Dock, London, for the purpose of the detention and isolation under official veterinary supervision of British Pedigree stock intended for export to the British Dominions overseas, is the subject of another part of the Report. The conditions of entry of animals into the Quarantine Station, the rules governing the control of the Station, and its successful working during the year of its inception are fully set forth.

There are also included the details of a new Order dealing with Anthrax in animals, which was issued during the year

* *Report of Proceedings Under the Diseases of Animals Acts for the Year 1928* : His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2, price 2s. 6d. net, 2s. 9d. post free.

extending the application of the Order of 1910 and in other respects amending its provisions.

The results of the administration of the Tuberculosis Order of 1925, which plays an important part in the campaign against that disease both in animals and in human beings, are fully recorded, and statistics are given showing the numbers and classes of animals slaughtered as diseased under that Order, the results of the post-mortem examinations, and the amount of compensation paid to the owners of the animals.

Other records show the incidence of the other notifiable animal diseases in Great Britain, namely, Sheep Scab, Swine Fever, Anthrax, Glanders and Parasitic Mange, and articles are devoted to the measures taken to prevent the introduction and spread of animal diseases, and to prevent avoidable suffering to animals and poultry during their transit by sea and on land. Statistical tables are added as to the numbers and classes of animals in Great Britain and those imported and exported.

* * * * *

As some farmers are desirous of obtaining independent and detailed reports on the carcass quality of the Wiltshire bacon pigs they produce, arrangements have been made with Messrs. Harris (Ipswich) **East Anglian Pig Recording Scheme** Ltd., Ipswich, and the St. Edmundsbury Co-operative Bacon Factory, Ltd., Elmswell, Suffolk, whereby, if pigs sold to either of these factories are dispatched to arrive on Tuesdays, an official of the East Anglian Pig Recording Scheme will examine and make a full report on the carcass quality of the individual pigs in the consignment. Pig producers wishing to take advantage of these facilities should notify one of the above factories of their intention of consigning such pigs for any specified *Tuesday* and should also give details of the ear-marking of the pigs (if any). The pigs will be bought and paid for at current rates in the ordinary way and suppliers may visit either factory and see their pigs weighed, graded and faulted.

The present methods of judging quality were outlined in the First Report on the East Anglian Recording Scheme. This Report, or further details regarding the above facilities, may be obtained from Mr. A. N. Duckham, Organizer, East Anglian Pig Recording Scheme, Department of Agriculture, University of Cambridge.

UNDER the auspices of the Royal Agricultural Society of England, in conjunction with the Institute of Agricultural Engineering, University of Oxford, **World Agricultural Tractor Trials** agricultural tractor trials are to be held in 1930. The trials, which will be open to machines manufactured in any country of the world, with no restriction as to weight or horse-power but limited to two machines of any one make or model, will consist of two parts, (a) tests of a scientific and practical nature, not open to the public, and (b) a public demonstration.

They will be carried out under the supervision of the Institute of Agricultural Engineering on land near Oxford. The dates proposed for the actual field operations are from June 1 to September 1, 1930 ; the public demonstration will take place on September 16-19 when entrants will be required to put their machines through their paces. The result of the trials will subsequently be published by the Institute in the form of a Report.

The detailed conditions for entry are already in print and can be obtained from the Secretary of the Royal Agricultural Society of England, 16 Bedford Square, W.C. 1. The latest date of entry is December 31, 1929.

* * * * *

THE school children of Northamptonshire have recently been engaged in the very novel and interesting task of making, under the direction of the County Education Committee, a **Northamptonshire Land Utilization Survey** utilization survey of all the land in their county. The children taking part in this work were mainly those from the elementary schools of the county, but they received some assistance from the secondary schools. Many farmers in the county also gave their help, and took great interest in the activities of the children. In carrying out this survey, the children received a good deal of practical map-making instruction in such matters as comparing the existing six-inch maps with the facts on the ground, bringing them up-to-date, and reducing to diagrammatic form information as to the utilization of the land which they acquired through their own observation.

The map recording the results of the survey has been printed for the Education Committee by the Ordnance Survey Department at Southampton. It is in three sheets on the one-inch scale, the distribution of cultivated land, pasture, woodlands

and waste being shown by means of different colours. Copies of the map are being placed in all the schools which participated in the survey.

This survey is a praiseworthy performance, and reflects great credit on the controller, Mr. E. E. Field, the school children, and the farmers who assisted. Work of this character is bound to have a stimulating influence on the young mind, and to create or develop an interest in rural life and activities.

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THE general position as regards wheat is that the world crop of 1929-30 will be substantially smaller than that of 1928-29, owing mainly to the poor results of the North American spring crops. With the aid, however, of the exceptionally large reserves of old crop wheat which were still on hand at the end of July, total supplies of wheat in the 1929-30 season should be adequate to meet the likely demand, but with a greatly reduced "carry-over" in July next. As regards feeding stuffs, supplies of barley, although smaller than in 1928-29, are likely to be again well over the average. The world crop of oats, however, may be below the average, and will certainly be below that of 1928-29. Supplies of maize are at the moment less than at this time last year, but heavy crops are expected in the autumn in the south-east of Europe, and the position will be much different when marketing of these crops begins. Available supplies of linseed are also smaller than at this time last year, while the prospects of the next Argentine crop, for harvest about December, are uncertain.

* * * * *

IN view of the interest shown at the demonstrations of horticultural machinery which were carried out in April, May and June last, the Ministry has decided to invite the collaboration of County Authorities in fruit-growing districts in arranging a further series of such demonstrations next year.

The Ministry is well aware that in some districts the intensive systems of inter-cropping adopted make the introduction of large power cultivating implements impossible; that in other districts the present lay-out of plantations is not well adapted to power cultivation; and that in general there are many factors involved in the question whether modern

methods and implements can be economically introduced into any particular orchard or orchards. The Ministry is satisfied, however, that horticulturists throughout the country will welcome the opportunity afforded by the proposed demonstrations of forming an opinion as to the efficiency, utility and economy of up-to-date machinery on their own holdings.

As the Ministry has already pointed out in the circulars distributed at this year's demonstrations, and in the note which appeared in the July issue of this JOURNAL, machinery which is to be used for cultivating fruit plantations is subject to certain limitations of height and width which, generally speaking, do not affect machinery designed for use in purely agricultural operations. For orchard work the machines must be capable of working close up to the trunks of the trees, of passing under the spreading branches of standards, and of turning on the narrow headlands without damaging the trees. In the case of motor units easy control is essential.

A number of the tractors and cultivating implements demonstrated this year, although showing an advance on previous models, were not entirely suitable for orchard work, but the Ministry understands that the problems connected with their necessary further adaptation are being considered by manufacturers.

The Ministry hopes that a number of tractors, a full range of large cultivating implements adapted to orchard work, and small power-driven implements for cultivation among soft fruit, may be available for demonstration next year.

* * * * *

AN important development in connexion with this scheme will, it is hoped, result from a conference of authorized packers

**National Mark
Egg Scheme**

which has been arranged to take place in London on October 23-24. It was foreseen when the scheme was launched that the experience gained during the initial period of working could be turned to account for the most effective benefit of the scheme only through the agency of a federation or association of packers. In recent months the Ministry has been strongly urged to initiate action which may lead to the formation of such a federation, and a circular letter on the subject which was issued to packers in August met with an immediate and favourable response from all districts.

The letter indicated that before the date of the proposed conference in London, packers might give the question their careful consideration in the light of their own local conditions. It was also suggested that useful preliminary work could be done if groups of authorized packers situated in convenient districts could arrange to meet locally and discuss the aims of the proposed federation, and any other matters connected with conditions of packing, buying and selling operations, etc., which had been found to be of practical importance. The Ministry will be guided by the results of these preliminary discussions in preparing the programme for the London conference, and will endeavour to collate the views of packers generally in such a way as to facilitate the work of the conference and make it of real and lasting service in improving the marketing of eggs under the National Mark.

Satisfactory progress has been made with the holding of group meetings in the twelve districts into which the country has been provisionally divided, and in at least one district the packers concerned have formed a District Association which it is expected will ultimately become a branch of a National Association.

* * * * *

A new Research Monograph, No. 6, entitled "A Survey of the Soils and Fruit of the Wisbech Area," has recently been issued by the Ministry.* This is the first

**Soils and Fruit
Survey**

of a series of surveys of the various types of fruit soils occurring in different areas of this country which the Ministry has undertaken to publish.

The farming community is frequently seeking advice as to the suitability of certain land for fruit growing, and in order to obtain the necessary information the Ministry's Conference of Advisory Chemists recommended in 1922 that attempts to correlate fruit culture with soil types should be made in East Anglia and in the West Midland counties. It was proposed that the surveys of soils and fruit in the two areas should be made by the Horticultural Research Stations at Cambridge and Bristol Universities respectively. These proposals were approved, and grants from the Development Fund were given for the work. Three surveys have so far been completed—two in the East Anglian area and one in the West Midland area. A second survey in the latter area is now proceeding. A

* *Research Monograph, No. 6*, obtainable from the Ministry, 10 Whitehall Place, London, S.W. 1, price 3s. 6d. net, post free.

fifth survey of a south-eastern area, carried out jointly by the South-Eastern Agricultural College (Wye) and the East Malling Research Station, has been commenced. The whole of this fruit soils survey work is being supervised by a special committee—the Fruit Soils Survey Committee—of the Advisory Chemists' Conference.

The monograph now issued contains an account of the work and results in the case of the first East Anglian survey—that of the Wisbech district—and is divided into three parts. Part I (Soils) gives a summary of the geology of the district; the water; sampling, selection and analyses of soils; and the types of soils. Part II (Fruit) gives a résumé of the history of the fruit industry, together with a survey of the industry at the present time, and an account of cultural methods. Part III (The Relation between Soil and Fruit) deals with the kind of fruit grown on the different soil types, and the effect of soil is considered separately in the case of apples, plums, pears, cherries, gooseberries, raspberries and strawberries. There are several detailed appendices containing tables of soil analyses, and showing the effect of the soil on various aspects of the fruit industry. Three maps are included, showing the soil types, tree fruit areas and strawberry areas respectively.

The monograph should prove of considerable value and interest not only to soil chemists and geologists, but also to fruit growers and the farming community generally.

* * * * *

GOVERNMENT grants are available to owners of agricultural land who desire to carry out works of field drainage, or schemes of water supply for groups of holdings.

Grants for Field Drainage and Water Supply	The grants are intended for the relief of unemployment as well as the benefit of agriculture. The <i>maximum</i> grant will be 33½ per cent. of the net cost, unless at least half the labour to be employed is
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obtained from certain depressed areas, and the locality of the proposed works is not in an area suffering from severe and prolonged unemployment. In such a case the grant may be increased to a maximum of 50 per cent.

The conditions upon which grants will be made are set out in full on pages 689-691, and copies thereof, together with forms of application for grant, can be obtained from the Clerk to the County Agricultural Committee at the offices of the County Council.

REDUCTION OF NATURAL SHELTER AND ITS INFLUENCE ON WILD FAUNA

J. ARTHUR THOMSON, M.A., LL.D.,

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GILBERT WHITE, who published his evergreen *Natural History of Selborne* in 1789, at the time of the French Revolution, was like Darwin in his appreciation of the linkages or inter-relations between living creatures, and in his vivid sense of the cumulative importance of minutiae. Both of these qualities are well illustrated by his famous letter on earth-worms, whose importance as soil-makers and soil-improvers he clearly recognized. But this was characteristic of Gilbert White's outlook—he had the vision of *the web of life*. In the heat of the day the Hampshire cattle stand in the forest ponds, and their dung, dropped into the water, forms a culture-ground for aquatic insects—a very welcome addition to the food supply of fishes in places where “the water is hungry and the bottoms are a naked sand.” He quaintly adds: “Thus Nature, who is a great economist, converts the recreation of one animal to the support of another.” How interested Gilbert White would have been in the modern disclosure of the part that Japanese cattle, standing in the water, play in the spread of the formidable human parasite called *Bilharzia*—but that is certainly another story.

Nothing lives or dies to itself. The naturalist of Selborne noted that troupes of water-wagtails run about the cows that are feeding in moist low pastures, and pick up the flies attracted to the cattle, or the other insects disturbed by their hoofs. How interested he would have been in the now familiar fact that these water-wagtails check the spread of liver-rot in sheep, since they are particularly fond of the little water-snail (*Limnæus truncatulus*), which is the host of the larval stages of the liver-fluke that causes the sometimes serious “rot.”

In application of this central ecological idea of inter-relations, we wish here to illustrate the results that may follow the reduction of wild corners throughout the country. From the farmer's point of view there is, no doubt, much to be said for trimming hedgerows and doing away with weedy borders and wild corners in fields, for these are often the haunts and nurseries of insects injurious to crops. Nevertheless, the other side of the account must not be overlooked, that hedgerows and the like afford shelter or cover to birds and other

creatures, many of which are conspicuously or inconspicuously the farmer's friends. The more garden-like a countryside becomes, the greater is the risk that useful components of the fauna will disappear for lack of shelter. Tidiness may easily be carried too far !

The Changes Going On.—Both Gilbert White and Charles Darwin realized, as we have said, the cumulative importance of little things ; and this must be kept in mind in connexion with changes in the countryside going on to-day. A particular reduction of shelter or cover may seem quite trivial, but the sum-total of results, over a large area and for a long stretch of years, may be of far-reaching importance. Another preliminary caution is that there are few changes which are one-sided in their results ; most are partly against and partly for human interests. We have no warrant for expecting that Nature—"friendly" as she often is—should always operate in man's favour. Thus, while there are a few birds, like wood-pigeons, that are almost wholly on the minus side as far as agriculture is concerned, and while the great majority are almost altogether to the good, of not a few it must be said that if they do some harm, they also do much good. There are familiar and long-standing arguments, pro and con, in regard to such birds as rooks, such mammals as moles, such insects as wasps. In many cases, like the last-mentioned, the data are not yet abundant and precise enough to warrant us in saying to which side—for or against agricultural interests—the balance swings.

It is also to be noted that the spread of agriculture is in itself bound to have a nemesis by promoting artificial situations. The Colorado Beetle was of no great moment as long as it fed in Colorado on its original food-plant, the Sand Bur *Solanum*, but when fields of potato (another *Solanum*) afforded abundance of appropriate food, and when field was joined to field across the United States, then there was a plague—still unconquered.

Reduction of Shelter.—The reduction of shelters includes (a) the extension of farm-lands over corners which had long retained their natural wildness, such as furze-covered commons where birds like Yellow Buntings used to breed, or slopes where the Badger or Brock used to burrow (how many local names begin with Brock !); (b) the stripping and restriction of the old-fashioned big hedges, which used to shelter useful mammals like Hedgehogs and useful birds like Hedge-

Sparrows ; (c) the replacement of hedges by wire fences and stone walls ; (d) the making of broad roads, at present so frequent, and in some cases necessary, the first stage being usually the removal of the often luxuriant strips on either side, and the substitution of covered-in drains for the old-fashioned ditches, in or about which many creatures had their home.

We must repeat that the ranks of the injurious are thinned as well as those of the beneficial ; but there can be no hesitation in saying that, from the agriculturist's point of view, there is much to be said for such mammals as hedgehog, weasel and shrews, and for such birds as thrush and black-bird, titmice and wheatear, robin and cuckoo. Scores might be added, which are more or less thirled to hedgerows and wild corners. Slow-worms, which are almost restricted to wild places, feed largely on slugs ; lizards are mainly insectivorous ; frogs and toads are all to the good ; and all these are dependent for continuance on the persistence of appropriate wild shelter.

Old and New.—In old days the cutting down of forests meant the disappearance of many animals, such as the Woodland Reindeer and the Elk, the Beaver and the Bear, the Wolf and the Lynx ; and our present point is that the dwindling of copses, hedgerows and wild strips, which are the "forests" for many small creatures, is being followed—and that inevitably—by a reduction in our fauna.

It is true, no doubt, that the wild fauna of Britain has not, as a matter of fact, diminished *quantitatively* in modern times ; but it has lost in *quality*. There has been a replacement of larger by smaller forms of life, and of the visible by the invisible. As Ritchie proves so convincingly in his great book, *The Influence of Man on the Animal Life of Scotland* (Cambridge, 1920), man "lops off the giants at the head of the scale, and adds pigmies at the bottom—insect marauders which enter unobserved and are often first noticed only when they force themselves upon his attention in their myriads." To gain rabbits and rats, cockroaches and bugs, is no consolation for losing reindeer and elk, beaver and pine marten, bustard and crane. Of course, no one dreams of proposing to reinstate bears and wolves (fox-farms and the like being an entirely different proposition) ; but no one can doubt the agricultural danger involved in over-thinning the ranks of insectivorous birds and of small carnivores that check the multiplication of small rodents.

To continue to argue from the past to the present, the necessary spread of cultivation and the breaking in of waste land long ago involved many disappearances, like that of the Great Bustard (*Otis tarda*)—once as common as a wolf, and now as conspicuous by its absence—or that of the quail (*Coturnix coturnix*), once as common as now it is rare. It nests occasionally in Scotland, but more frequently in Shetland, where the “reaper” is still unknown. “There, after the manner of the old days, the scythe or the sickle still mows the waving corn, and the quail reaps the benefit of such peace as a primitive cultivation gives.” The immediate point is whether what happened to the Bustard and the Quail is not now happening to the Corncrake and, perhaps, also to the Lapwing, best of “farmer’s friends.” It is not merely that these birds do not approve of reaping-machines: there is a reduction of rough corners beside fields and of quiet places generally. Even when the hedge has gone, the partridge often finds a suitable nesting place in the rough growth beside a roadside wall, and on the outer side as well as on the inner! But even these residual strips are being reduced, and in proportion as things become “spick and span” the birds become scarcer.

We do not counsel the impracticable, for cultivation must needs become more extensive and more intensive; but it is a practical question whether there might not be more conservation of wild corners as sanctuaries for beneficial animals. Yet again, in all these balancings of pro and con, we must be jealously fair, and while there has been in some highly cultivated parts of the country a diminution of the finer butterflies, for instance, that used to be common, and this as the result of the elimination of the caterpillar’s food-plants from hedges and fallow strips, the same will be true in regard to many *injurious* insects. So the reduction of wild shelters cuts both ways.

But this all-round fairness is a little apt to lead us to be too optimistic; the ominous fact is that there has been a serious reduction of the native shelters for useful birds and beasts. Dr. Ritchie puts it well: “With the breaking in of the wild banks and braes—‘the burnin’ yellow’s awa’ that was aince alowe, On the braes o’ whin’—the nesting sites for many small birds and the shelters for many small rodents and insectivores have disappeared, to the grievous reduction of their kinds.” We have deliberately cited this reference to rodents as well as insectivores, though the rodents are the

farmer's foes while the insectivores are his friends. Nature is very fair-minded ; she is not prejudiced in favour of farmers.

Drainage Plus and Minus.—Another useful analogy may be found in the results of drainage, ancient and modern. In old times there were enormous tracts of Britain in the state of peat-bogs and fens. Curlew and bittern, water hens and snipe used to be at home in what is now Belgravia, and the same may be said of many a prosperous farm. As drainage became common and effective, vast swamps were reclaimed for agriculture ; and Britain lost its cranes and bitterns—the latter now happily returning to breed in the Norfolk Broads. This drainage had, of course, its plus side, for thousands of acres of swamp became farm-land, and as drainage meant a reduction of pools suitable for mosquito larvæ and fresh-water snails, there was a diminution of malaria or ague, once very common in Britain, and of liver-rot in sheep, still abundant in places where effective drainage is difficult. What happened in the past on a large scale is now happening in many places on a small scale. There is a reduction of ponds and pools, bogs and ditches, and while this has its agricultural and sanitary value, there is no use trying to ignore the tax to pay.

Even on golf courses, which have their ecological aspect as reservations for wild life, there is a persistent tendency to reduce the "rough" and to dry up "the pleasant places of the wilderness"—all with the result that many wild flowers which once were common have now vanished, and that many birds, whose presence used to console the bad golfer, have said farewell. The inevitable nemesis comes, even to the well-entrenched golf club, when there are not birds enough to check the multiplication of Daddy-Longlegs and Click-Beetles, whose larvæ, the "leather jackets" and wireworms, are so hostile to the turf. So far as we know, it serves little purpose to allow a pond-surrounding, swampy nesting-ground of Black-headed Gulls to become so dry that the birds abandon it ; and one of the immediate results is that the adjacent fields, formerly so free from insect pests, thanks to the appetite of this useful species of gull, are no longer exempted. We do not pretend that this has been proved by a careful statistical correlation of the amount of swampy ground and water-surface, the number of gulls in the gullery, and the abundance of injurious insects in the surrounding fields—inquiries that take time and have also to be corrected in

relation to weather, farming, and crops—but the observational impression is as we have stated.

Dr. Ritchie gives details of a very instructive history of Black-headed Gulls. They came (1) in 1892 or 1893, to a heather-moss, with peat and moisture underneath, on the southern slopes of the Pentland Hills; (2) they were protected and encouraged by the proprietor, who fed his young pheasants on the gulls' eggs; (3) they nevertheless flourished, the last clutch being always left to hatch; and (4) they increased enormously till (1897) there were 1,500-2,000 pairs of birds. The grouse that used to frequent the heather disappeared. But with the extension of the gullery, the vegetation (5) underwent a noticeable change, the heather being replaced by abundant coarse grass, which was cut for hay, then by a dense growth of rushes, both (6) becoming almost choked by a forest of docks. Whereupon the villagers, angry at the destruction of their hay crop, made persistent raids on the gullery, and the proprietor, regretful at the disappearance of grouse, ceased to protect the gulls for his pheasants. In 1917 not more than thirty pairs nested, where a few years before there had been some two thousand pairs. Then the vegetation began to change back again (7), the docks and rushes giving way to rough grass and even to heather. Finally, the grouse began to return!

Roads and Horses.—We have referred to the trimming and broadening of roads with the resulting decrease of shelter, but there are two other points to be considered. The modern road adapted to motor-traffic has in many cases something in the way of tar-macadam or asphaltting; and it is generally believed that the wash after rain is detrimental to the small animals in ditches and streamlets, and directly or indirectly to trout and salmon in the adjacent rivers. This may possibly mean the destruction of the young stages of some injurious insects, but it also implies a reduction of part of the food-supply of insectivorous birds. It may be replied, however, that this will be far more than outweighed by the augmentation of insects implied in the increase of farm-land with its abundance of suitable food-plants. The issues are so manifold and criss-cross that it is next to impossible to predict the final result of more or less necessary changes; but the general proposition is this, that extensive crops afford super-abundant food to insect-pests—such as turnip green fly, turnip moth, turnip saw-fly, turnip flea-beetle and diamond-backed moth; that a promiscuous counteractive of these

plagues is the multiplication of the birds which prey upon them ; and that this implies a conservation of suitable shelter and cover.

The numbers of field-insects must be incalculably greater than in old days, when agricultural operations were less extensive ; and that ought automatically to mean more birds. Yet it may sometimes mean a disproportionate increase of certain types of bird, such as starlings, which are apt to drive away smaller insect-eaters, like wrens, robins and warblers, which, moreover, are more dependent on the minor shelters like hedgerows, the starlings mostly roosting in trees.

Some birds, that are largely seed-eaters, like the finches, may be beneficial to agriculture inasmuch as they feed their young on insects. Thus the common Yellow Bunting or Yellow Hammer, which depends on seeds and small fruits in winter, is largely insectivorous in summer, and feeds its young on insects. The fact that it, like the Hedge Sparrow, is also fond of spiders, may be noted as an instance of the difficulty of balancing pros and cons, for spiders are very useful in checking the multiplication of small insects.

In many parts of the country where the Yellow Hammer used to be very common, there is now a marked scarcity. This is ascribed by some to the fact that there is of recent years so little horse-dung on the roads ; it used to be a common sight to see the Yellow Hammers picking up the undigested grains of oats.

In Conclusion, it is quite certain that the food of many wild birds consists largely of injurious insects which are a continual menace and involve a huge annual loss which our country can ill afford. Thus there might be mentioned from the long list the following representative birds : titmice, lapwings, hedge sparrow, redbreast, skylark, thrush, wagtail, warblers, pipits and flycatchers. These and scores of other birds are worthy of preservation on grounds of utility—let alone higher values—and one way of securing their survival is to refrain from being over-zealous in doing away with more or less harmless shelters.

* * * * *

SUBTERRANEAN CLOVER AND WINTER-KILLING

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AND

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SUBTERRANEAN clover (*Trifolium subterraneum*) has been under study at the Welsh Plant Breeding Station since 1920.* The seed used has always been obtained from Australia. This seed produces plants which are very much larger than the indigenous types found on some of the cliff-side pastures near Aberystwyth.

A detailed study of this species of clover, however, shows that it consists of a very large number of forms, which have a wide range of growth-habit, of earliness and lateness, and of powers of seed setting. It is not, however, the purpose of this article to deal with the selection and breeding work now in progress, but to review briefly the question of the swarding ability of the plant in the case of tests made with the ordinary Australian seed of commerce.

Continued Self-establishment in Relation to Date of Sowing.

—Subterranean clover is an annual plant which, when sown at the correct date, behaves as a "winter annual" and by re-seeding in the early summer maintains itself from year to year. Trials which have been previously reported upon have shown that in Wales the seed should not be sown earlier than about the middle of June if it is desired to establish the plant as a winter annual.

The evidence from broadcast plots sown in 1924 is worthy of brief consideration in this connexion. Counts made on the plots at different dates may be usefully summarized as under:—

Average Number of Plants in average quadrat of $2\frac{1}{2}$ sq.ft.		
Counts made September, } April-sown, 1924	2 plants	
1928 (2nd harvest year) } June-sown, 1924	716	"
Counts made in June, } April-sown, 1924	0	"
1928 (4th harvest year) } June-sown, 1924	48	"
Counts made in June, } April-sown, 1924	0	"
1929 (5th harvest year) } June-sown, 1924	0	"

* Williams, R. D., and Davies, Wm. A Note on Subterranean Clover (Australian variety). Welsh Plant Breeding Station Bulletin, Series H., No. 3, p. 151, June, 1924.

Davies, Wm. Observations on Subterranean Clover. This JOURNAL, Vol. XXXIV, No. 5, p. 455, August, 1927.



Subterranean Clover (*Trifolium subterraneum*).

The original sowing in 1924 (both on the "April" and "June" plots) was at 8 lb. per acre. The 48 plants per 2½ square feet on the plots in June, 1928, would have represented a seeding of as much as 11 lb. per acre, even supposing that every seed sown had produced a well-established plant. Thus by the fourth harvest year there were more established plants per acre on the sward on the plots sown at the correct date than corresponded to the actual amount of seed sown in 1924.

Further counts made on the "June" plot in June, 1928 (fourth harvest year), showed that there were on the average 224 seed heads per 2½ square feet. It was thus obvious that the seed harvest of 1928 was eminently satisfactory, and this was confirmed by the large number of seedlings on the ground in September of that year: evidence which on the basis of the data for the previous years would have suggested a strong plant of subterranean clover being again present on the sward in 1929 (fifth harvest year). In fact, however, every single seedling was winter-killed during the unusually severe winter of 1928-29, with the result that the most thorough search did not reveal a single plant of the clover in the sward in June, 1929.

Winter-killings.—In all the sward trials with subterranean clover about 6 cwt. to the acre of high-grade basic slag was used at the time of sowing, and in the case of all the trials conducted in the vicinity of Aberystwyth no extensive or serious winter-killing had been observed on plots sown at the correct date until the unusually hard winter of 1928-29.

It has, of course, been generally recognized that subterranean clover is not highly resistant to severe winter conditions; the results under review, however, show that sufficiently severe conditions can occur even near the sea in Wales to kill the plant completely. It should be pointed out, however, that the plots immediately under discussion were situated on a very exposed field, and that the sward had been grazed very hard by sheep (on an intermittent basis) all through the winter and early spring.

Fortunately other plots were also available for study, and the data from these (brought together in the statement hereunder) afford further valuable evidence as to winter-killing of subterranean clover.

TABLE SHOWING PARTICULARS OF EXPOSURE, INTENSITY OF GRAZING DURING AUTUMN-SPRING PERIOD 1928-29, AND NUMBER OF PLANTS PER 2½ SQ. FT. THAT HAD OVERWINTERED, AND PER CENT. ESTABLISHMENT IN JUNE, 1929.

Centre	Date of sowing	Area	Particulars of exposure	Intensity of grazing	Plants per 2½ sq.ft. in June, '29	Per cent. establishment in June, '29
Bank (1)	June, 1924	1-10th acre	Fully exposed to north winds : elevation 400 ft.	Very hard (sheep)	Nil	Nil
Gorse Field Marsh (2)	June, 1928	2½ acres	Rather exposed to north winds : elevation 300 ft.	Light (horses)	1.2	2.9
Cilmery Park, Bulth Wells(3)	July, 1928	4 acres	Facing east : elevation, 700 ft.	Light (sheep)	3.2	3.9
Penglais Field(4)	July, 1928	1½ acres	Elevation 320 ft. Exposed to north wind : partially sheltered by trees	Light (sheep)	6.5	15.9
	Area B		Not quite so exposed as Area A		11.0	26.9
	Area C		Facing S.W. and sheltered by trees		29.0	70.9

(1) The June-sown trial previously discussed ; two plots each 1-20th acre, 8 lb. per acre sown alone and 8 lb. per acre in a mixture with 14 lb. Italian rye-grass.

(2) Sown at 12 lb. per acre in a simple mixture.

(3) Sown at 20 lb. per acre in pure plots.

(4) Sown at 10 lb. per acre in simple mixtures.

Broadly considered, these results show that the extent of killing during the severe winter 1928-29 was largely determined by the exposure to cold winds—thus on the most sheltered area a quite satisfactory number of plants had overwintered, and the percentage establishment of seed sown had been high. Favourable aspect and shelter (*e.g.*, by trees) is, however, by no means the only factor which tends to lessen winter-killing. All the areas on the Penglais field were only lightly grazed during the autumn-winter-spring, and all through this

period the small subterranean clover plants were afforded shelter by the Italian rye-grass (included in the mixture) and which was seldom grazed hard to the ground. At Cilmerly Park, where the exposure was intense and no "nurse" plants were sown with the subterranean clover, the overwintering was negligible, but the counts made in the summer of 1929 indicated that the number of survivals was much larger in hollows and in areas sheltered by bracken than elsewhere.

The soil on the Gorse Field Marsh was heavy and ill-drained, and here, despite shelter from sown Italian rye-grass (consequent on light grazing), the winter-killing, as was to be expected, was very severe.

Summary and Conclusions.—The importance of sowing subterranean clover at the correct time, namely, not earlier than the middle or end of June, has again been demonstrated.

Although in West Wales subterranean clover (sown at the correct time) had not been winter-killed to any appreciable extent during the four winters previous to that of 1928-29, it was so killed to a serious extent during that exceptionally severe winter.

The results under discussion have tended to indicate that winter-killing is in direct proportion to the degree of exposure of the situation and to the degree of heaviness of the autumn-winter-early spring grazing.

The practical conclusion to be drawn is that subterranean clover is not a suitable plant for using in districts normally subject to severe winters, and that in districts with reasonably mild winters the danger of winter-killing in exceptional years can be greatly reduced by selecting sheltered fields on the lighter and well-drained soils and by sowing in a simple mixture and not grazing too hard during very cold periods.

STATE-AIDED LAND DRAINAGE WORKS IN THE MIDDLE LEVEL DISTRICT OF THE GREAT OUSE CATCHMENT BASIN

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AMONG the numerous State-aided works of land drainage which are now being carried out in different parts of the country, probably the largest, and in some ways the most interesting, are those in progress within the area known as the Middle Level District of the Great Ouse Catchment Basin.

This district is under the control of the Middle Level Drainage and Navigation Commissioners, who are a drainage and navigation authority dating back well into the eighteenth century. Their district comprises about 123,000 acres of some of the richest land in England, and a large proportion of it is, as in the case of most of the land in the fen country, below the level of the sea. Most of the water, therefore, which the Middle Level are responsible for discharging into the Ouse, has first to be pumped from small internal districts into the main carrier drains over which the Commissioners exercise their jurisdiction.

The works which are now being carried out with the aid of a Government grant are especially interesting because some of them are being completed with the aid of transferred labour from certain of the mining areas in this country, and if there has ever been any doubt as to the efficiency of these men and their capacity for work, those doubts would be rapidly dispelled by a visit to the locality.

The works may best be considered under three groups. In the first place, the Commissioners are carrying out a thorough regrading and clearing of the main drains which are designed to carry the water from the internal districts to the River Ouse, into which they discharge at the point known as St. Germans Sluice. Dredging with mechanical plant is being done on these drains at various points, perhaps the most important of which is in the main drain, known as the Middle Level Main Drain, which traverses eight miles of territory outside the jurisdiction of the Commissioners, and consequently has to be maintained in a state of high efficiency to avoid the flooding of land under the jurisdiction of other drainage authorities.

This work of clearing main drains has been going on for three years, and is likely to last another three years. A view of the work (*see* Fig. I) on the main drain shows not only

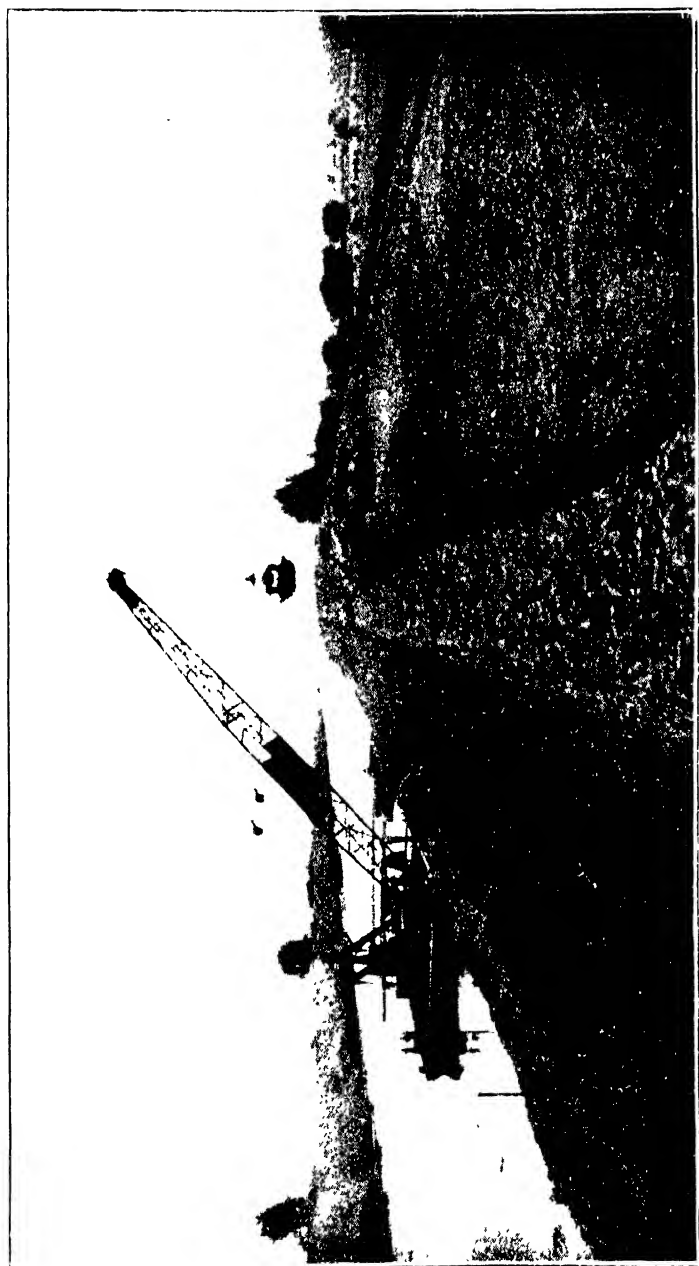


FIG. 1. Showing the reconditioning of the Middle Level Mam Drain and the method of depositing the excavated material.

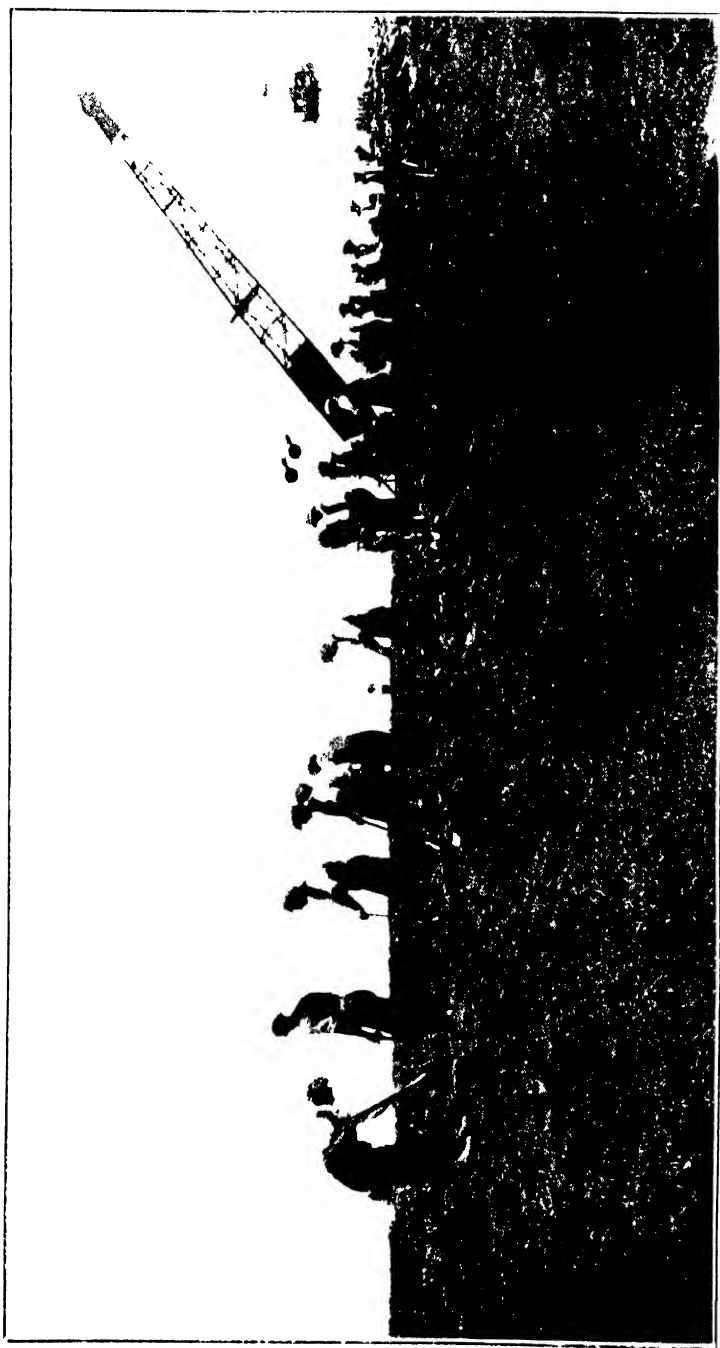


FIG. 11. —Middle Level Main Dam Spreading the excavated material.

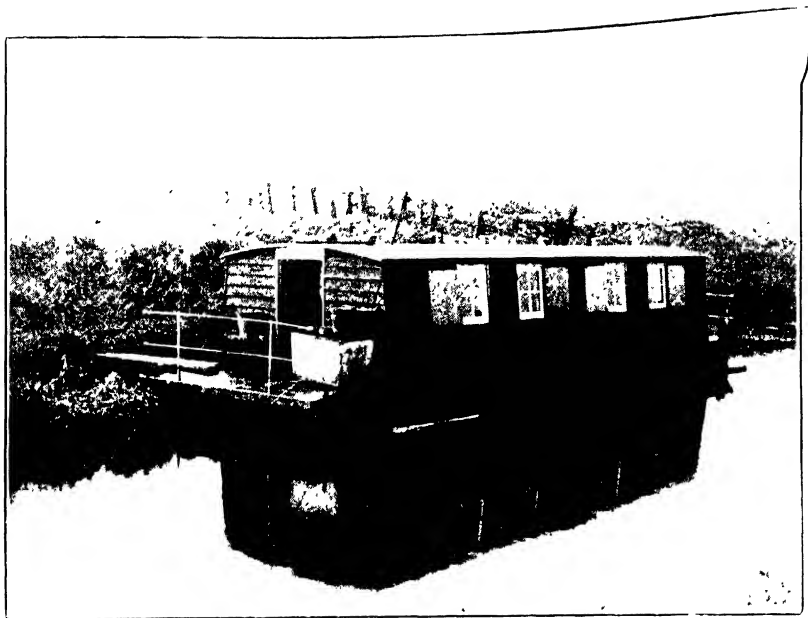


FIG. III. —Houseboat used to accommodate miner labour employed on drainage work.

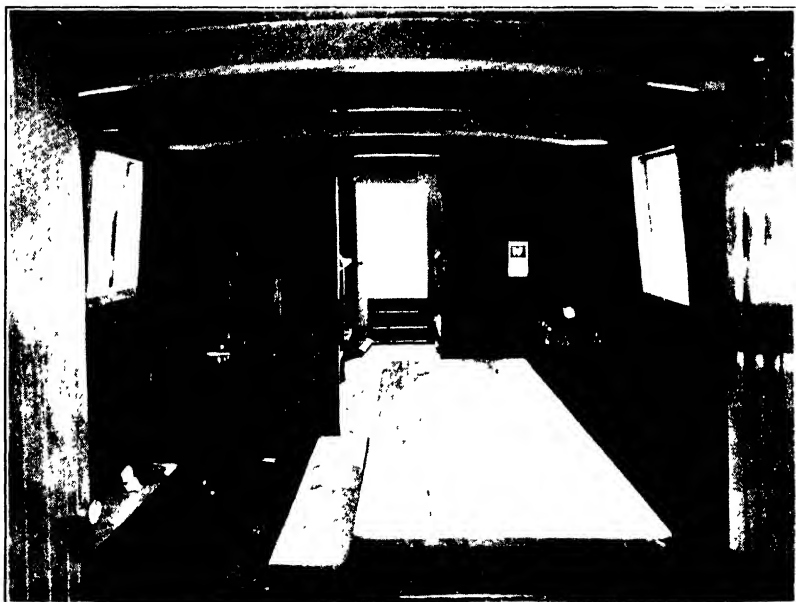


FIG. IV. Interior of houseboat. Messroom with cooking stove. Sleeping accommodation beyond.

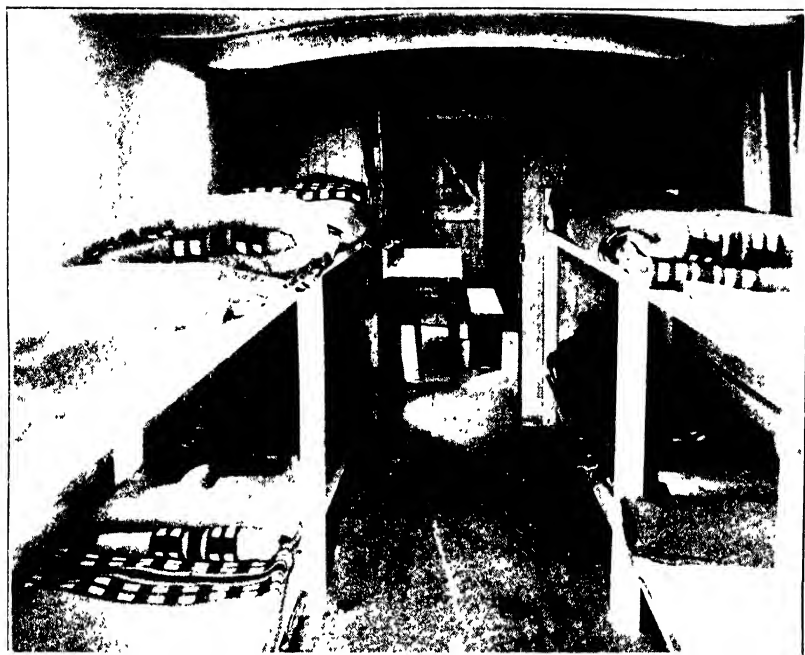


FIG. V. Interior of houseboat. Sleeping accommodation for eight. Messroom beyond.

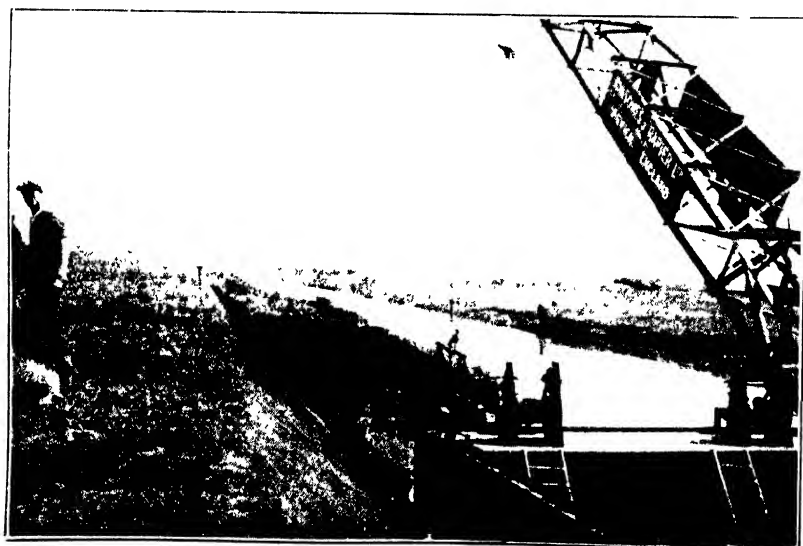


FIG. VI. Showing dredger at work on enlarging River Delph and removing spoil on to Middle Level Barrier on left. To right, the Washlands.



FIG. VII.—Borrow pit ; showing excavation of clay for raising and strengthening Middle Level Barrier Bank.

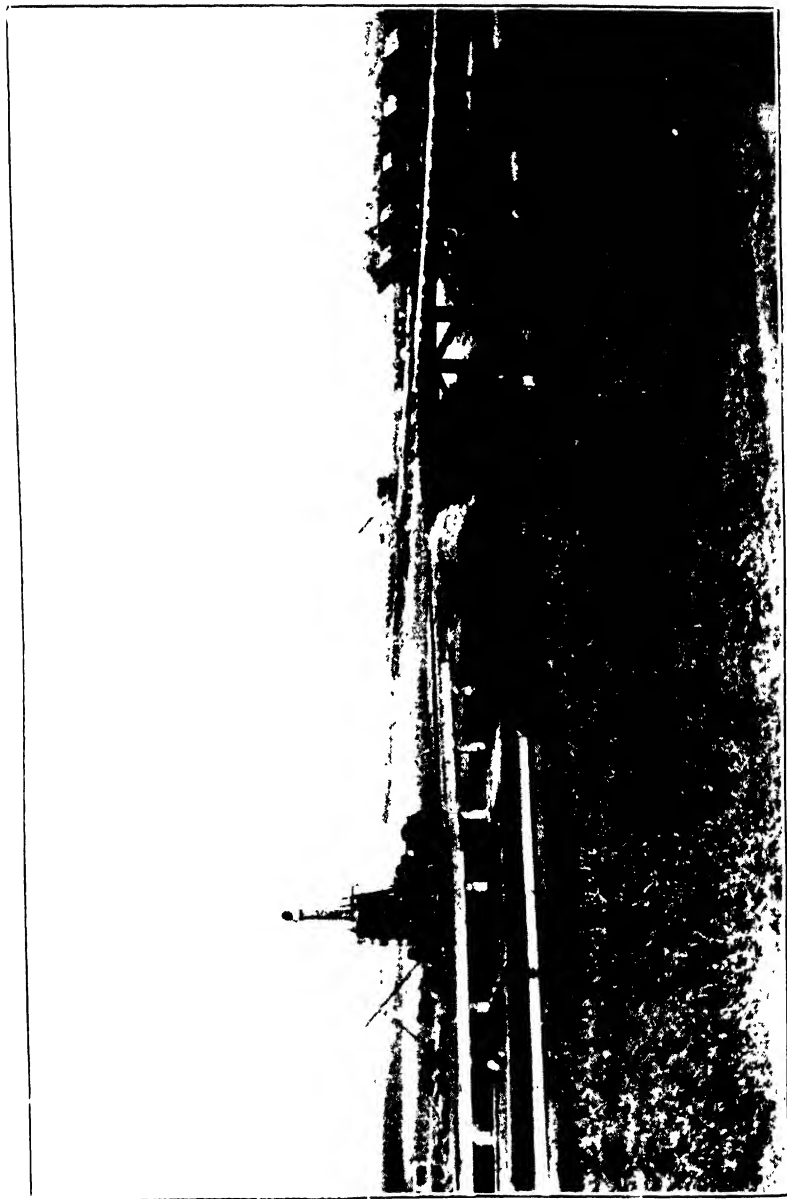


FIG. VIII.—Spoil from borrow put in rear being trucked on to Middle Level Barrier Bank for raising, etc.

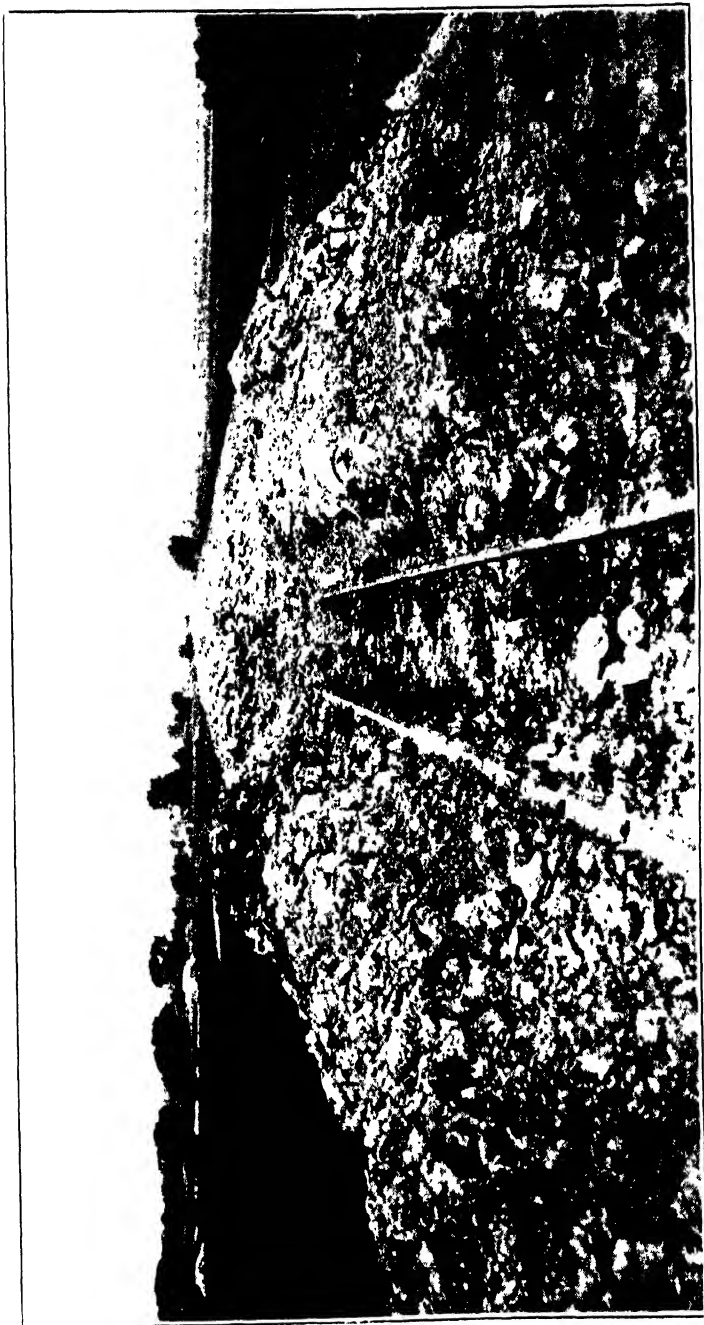


FIG. IX.—Middle Level Barrier Bank: showing spoil from borrow pit for raising and strengthening. To the right are the Washlands, completely under water in winter.

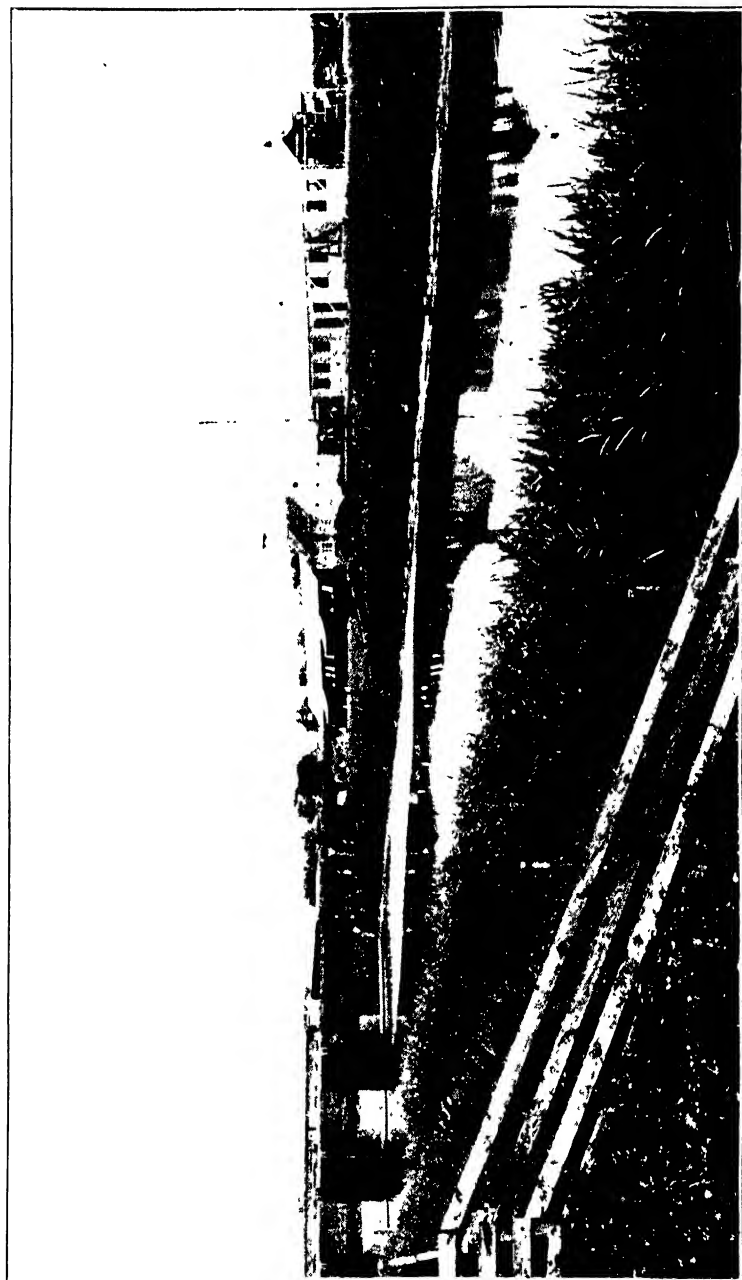


FIG. X.—Showing the specially-built hutted camp, and the St. Germans Sluice or left.

the amount of material which is being taken from the drain, but also the method of depositing it for bank strengthening between retaining walls. Fig. II shows the work of spreading in progress. This main drain has not been reconditioned since it was first constructed nearly 70 years ago. Some miles of it have now been reconditioned. The total cost of all this scheme will amount ultimately to £120,000, of which the Ministry is paying 50 per cent. At the present time there are five floating dredgers and one drag line dredger engaged on the work.

Fifty per cent. of the labour now being employed consists of transferred men, i.e., they have been recruited from the mining arcas. The men are housed in barges (*see* Figs. III, IV and V) which are moved from place to place as the work progresses. These barges, which have been specially designed and constructed by the Middle Level Commissioners, consist of two main rooms—one a living room and the other a sleeping room—the latter containing accommodation in bunks for eight men.

The men make their own catering arrangements and find their quarters comfortable. Each boat is supplied with a pump for getting rid of extraneous water, a stove, a filter, and the necessary lockers both for food and clothing.

The second piece of work consists in raising and strengthening what is known as the Middle Level Barrier Bank, which lies between the Middle Level District and the River Ouse (at this point known as the Hundred Foot River), and therefore protects the former from the latter. Between the Hundred Foot River and this Barrier Bank are the Washlands, into which the Ouse overflows in the winter months when it rises to a certain height. Subsequently the flood water from the Washlands finds its way into a catchwater drain situated near and parallel to the Barrier Bank, finally discharging into the Ouse at a point lower down stream.

There are altogether about 16 miles of the Middle Level Barrier Bank to be dealt with, and its maintenance is a matter of vital importance to the Middle Level District. Here, also, miners are to some extent being employed and, again, with considerable success.

Material for the bank is being obtained, when suitable, from the catchwater drain above referred to, which is at the same time being enlarged, and this operation can be seen in Fig. VI. It is not possible, however, to obtain the right material for bank strengthening from this drain throughout its entire length, and a considerable length of bank, therefore, has had

to be raised with clay taken out of a borrow pit situated on 18 acres of land, purchased many years ago by the Commissioners, who realized that the land would ultimately be required for the purpose. A view of the borrow pit is given in Fig. VII which shows a Ruston and Hornsby drag line dredger, working on crude oil, excavating clay. Clay is trucked up from the borrow pit and hauled along the bank by small locomotives to the spreading point. Fig. VIII shows the trucks on their way to the bank with the borrow pit in rear, and Fig. IX shows the end of the track on the top of the bank, where the spoil is discharged and spread. The works are likely to last another three years, and the total cost will be about £60,000, of which the Ministry is paying 50 per cent. At the moment, about 200 men are at work on the last two schemes.

The third and largest section of work involves the replacement, on an adjoining site, of the sluice at St. Germans (through which all the water of the Middle Level District discharges into the Ouse), by a larger and more effective sluice in which it is proposed to instal a high-power pumping plant.

The actual work of the sluice has not yet been begun as it has been necessary to construct a considerable hutted camp, which may almost be regarded as a model of its kind. This special accommodation is necessary as there is no existing lodging accommodation for the miners, who are to be employed upon the scheme to the extent of 75 per cent. of the total number of men required.

Provision has been made for hutted sleeping accommodation, mess rooms and recreation room, etc., together with a brick-built cook-house. All the floors are made of concrete to facilitate cleaning. A view of this camp is shown in Fig. X. In the event of additional labour being required, this can be accommodated on the site as required in house-boats of the kind already described.

The total cost of this last work is estimated at about £200,000, and the Unemployment Grants Committee are finding 75 per cent. of the loan charges for the first 15 years, and 37½ per cent. of those charges for the second 15 years of the loan period. It is not likely to be completed under three years, and the probable number of men to be employed continuously is 150.

All the works above described are being carried out by direct labour under the direction of Major R. G. Clark,

M.Inst.C.E., Engineer to the Middle Level Drainage and Navigation Commissioners, and his assistants; and under his capable guidance the works are proceeding apace and should confer a wide and lasting benefit over this important area. I am indebted to Major Clark for procuring the photographs that accompany these notes.

It is only necessary to see these operations to realize the magnitude of the precautions which those responsible for a Drainage District of this size and character have to take, not only to secure adequate drainage, but also, which is almost more important, to avoid risk of inundation.

* * * * *

THE PRACTICAL STERILIZATION BY HEAT OF SMALL QUANTITIES OF SOIL

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THE sterilization* of soil by heat, widely practised by cultivators of glasshouse plants, has become extensively adopted by market gardeners in general, among whom are to be found many who speak enthusiastically about the results they have obtained. Not only are pests and diseases eliminated in the seed bed, but the greatly increased fertility of the sterilized soil and the increased vigour that results ensure a healthy constitution which makes the cultivation of plants a pleasure.

In practice, the soil is heated to a temperature of 210°–212° F. (just at or below that of boiling water), and is maintained there for periods varying from 15 to 40 minutes in accordance with the type of soil and the nature of its contaminations. Heavy soils require to be heated for longer periods than light, sandy soils; but generally, 30 minutes at 210°–212° F. is sufficient. For reliable results every part of the soil must be heated equally.

The necessary heating is obtained either by passing steam through a heap of soil or by baking the soil in an oven or some suitable apparatus.

Steaming versus Baking.—A good deal of controversy has arisen between those who favour one of the above methods in preference to the other. Actually both methods are beneficial if properly conducted with due regard to the type of soil and the nature of its contaminations.

* In the present paper, the word "sterilization" is not used in its strict micro-biological sense, but as equivalent to "partial sterilization."

Both methods increase the fertility of the soil, for they convert complex organic and inorganic substances into simpler forms, which are either absorbed directly by plant roots, or are quickly changed into useful plant foods by certain bacteria resistant to heat which are not destroyed. Further, these bacteria find unlimited scope in the sterilized soils because other organisms, which compete with them in normal soils but are less resistant to heat, are destroyed during sterilization. Both methods destroy fungi and bacteria which infect plant roots and cause disease.

Baking is more severe upon the soil colloids than steaming, and it is not surprising to find that baked soil differs appreciably from steamed soil in physical condition. Baked soil is more difficult to handle in pot work than steamed soil, for it dries out more quickly and requires more attention. Many tomato growers refuse to use it for this reason, and many have been led to mix it with virgin soil to improve its water-holding capacity. This procedure cannot be advised, however, for there is grave risk of introducing diseases with the unsterilized virgin soil. When baking a soil, it is possible to over-heat it, especially if the soil is on the dry side, and, when this occurs, the soil becomes "dead" and will not support plant growth. Seedlings planted in it turn blue and hard, and grow very slowly, if at all.

Steamed soil has been criticized as "often turning out of the sterilizer like so much thick mud." When this occurs the method is wrong. Either the soil was too wet at the beginning or the steam pressure was too low. It is practically impossible to over-heat the soil by steaming, unless dry superheated steam is used.

Apparatus Used in Heat Sterilization.—Many devices have been invented by nurserymen and others for the purpose of steaming and baking soils in quantities varying from $\frac{1}{2}$ ton to 3 tons or more. The object of this paper is to draw attention to the most important of these and, by discussing their merits, assist growers to select a type best suited to their requirements. Sterilization on a large scale has been discussed in a previous paper (1).*

Steaming.—The simplest apparatus for steaming small quantities of soil consists of a suitable receptacle and some means of introducing steam, either through a grid laid on the

* Figures in brackets refer to references at the end of this article. The substance of the previous paper has been published by the Ministry as Leaflet No. 209, a copy of which can be obtained at 10 Whitehall Place, London, S.W. 1.

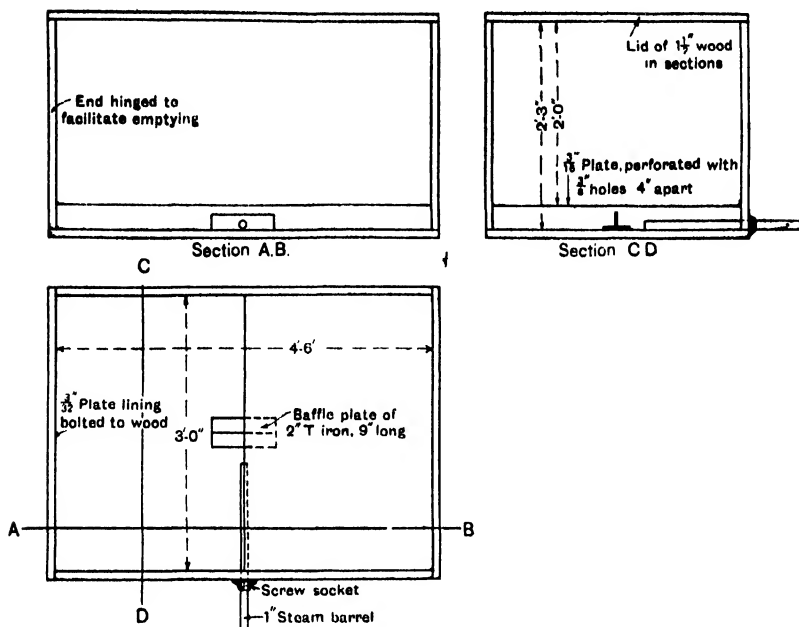


FIG. 1.—Box method of steaming.

bottom or through a perforated false bottom. Fig. 1 illustrates the construction of a box which has proved effective on many nurseries. The box, 4 ft. 6 in. long, 3 ft. wide and 2 ft. 3 in. deep, holds about one ton of soil. The sides, ends and bottom are made of 1-in. wood to which iron sheets, $\frac{3}{32}$ -in. thick, are bolted on the inner side. One end is hinged at the bottom and can be let down to facilitate emptying. A false bottom, consisting of $\frac{3}{16}$ -in. plate, is perforated with $\frac{3}{8}$ -in. holes placed 4 in. apart. It is fixed on angle irons 3 in. above the real bottom and can be taken out at will. Steam is introduced by means of a piece of 1 in. steam-pipe screwed into one side below the false bottom, the pipe extending to within 4 in. of the centre of the bottom, where a baffle-plate is fixed to disperse the steam as it issues from the pipe. Soil is placed on the false bottom until the box is filled, and a lid of 1-in. wood, in two sections, is laid on the top of the box. It is also an advantage to throw a tarpaulin or sheet of sail-cloth over the top while steaming. Steam is passed until the temperature of the entire heap rises to 210° – 212° F., and is continued for 20 to 30 minutes afterwards.

Alternatively, the false bottom can be replaced by a grid, laid in the bottom of the box. The grid is constructed of 1-in. iron piping, and consists of three branches 15 in. apart, the whole covering an area 4 ft. 5 in. long and 2 ft. 7 in. wide. The

branches are plugged at the ends, and steam issues from $\frac{1}{4}$ -in. holes placed alternately on each side at intervals of 3 in. The holes should be drilled on the sides of the barrel just below the horizontal diameter, to prevent choking.

The construction of the box can, of course, be varied at will, but it should not be deeper than 2 ft. Many receptacles have been made of concrete, and it is convenient to leave one end open for emptying purposes. During steaming, the open end can be closed by means of an iron sheet fitted with lifting handles. It is also convenient to raise the box, or concrete trough, to the level of a cart, to facilitate loading and emptying.

A simple form of steaming apparatus, the Cheadle Royal, based on that employed by Messrs. Clibrans, of Altrincham, is described by Falconer (2), who added several improvements. Mr. Falconer was able to use an existing steam supply at from 60–70 lb. pressure, and by means of some $\frac{3}{4}$ -in. galvanized steam piping, with check valves and grids, he evolved a simple and effective sterilizer at a cost of about £5 for material. As shown in Fig. 2, the sterilizer was erected against an inner wall of a shed. He says in his paper, "Our sterilizer consists of a trough or bed, divided in the middle to make two receptacles, and is built with 9 in. brickwork and cement. The inside measurement of each bed is 5 ft. 3 in. long by 2 ft. 9 in. wide, and 1 ft. 8 in. deep. This will hold exactly one cart-load of soil. Brick pillars are built at each end and in the middle, a slot being left in each, near the front, to allow two sheet-iron doors (of $\frac{1}{4}$ -in. thickness, with handles attached) to be lifted in and out and thus facilitate the shovelling-out of the soil. The door measurements are 5 ft. by 1 ft. 8 in. The bottoms of the receptacles are made up with concrete and a facing of cement. There is a slight drop in the level from the main steam-pipe towards a condensation pipe fitted with a valve at the low end of the bed, in order to draw off condensation water before each refill. The method of utilizing the steam to the best advantage, so that each portion of soil gets uniformly steamed, is provided for by a grid of steam-pipes attached to the main pipe, at right angles—a valve being fitted to each branch of the inlet pipe for controlling the inlet of steam. The grids fit into small channels sunk in the cement bed—in order to carry away any superfluous moisture—and are arranged 4 in. from the wall all round, with 8 in. between the middle sections. Each grid consists of four sections of $\frac{3}{4}$ -in. steam-piping, with $1/16$ -in. holes drilled every 6 in. at the top, with two holes drilled between each of these on either side, each at a

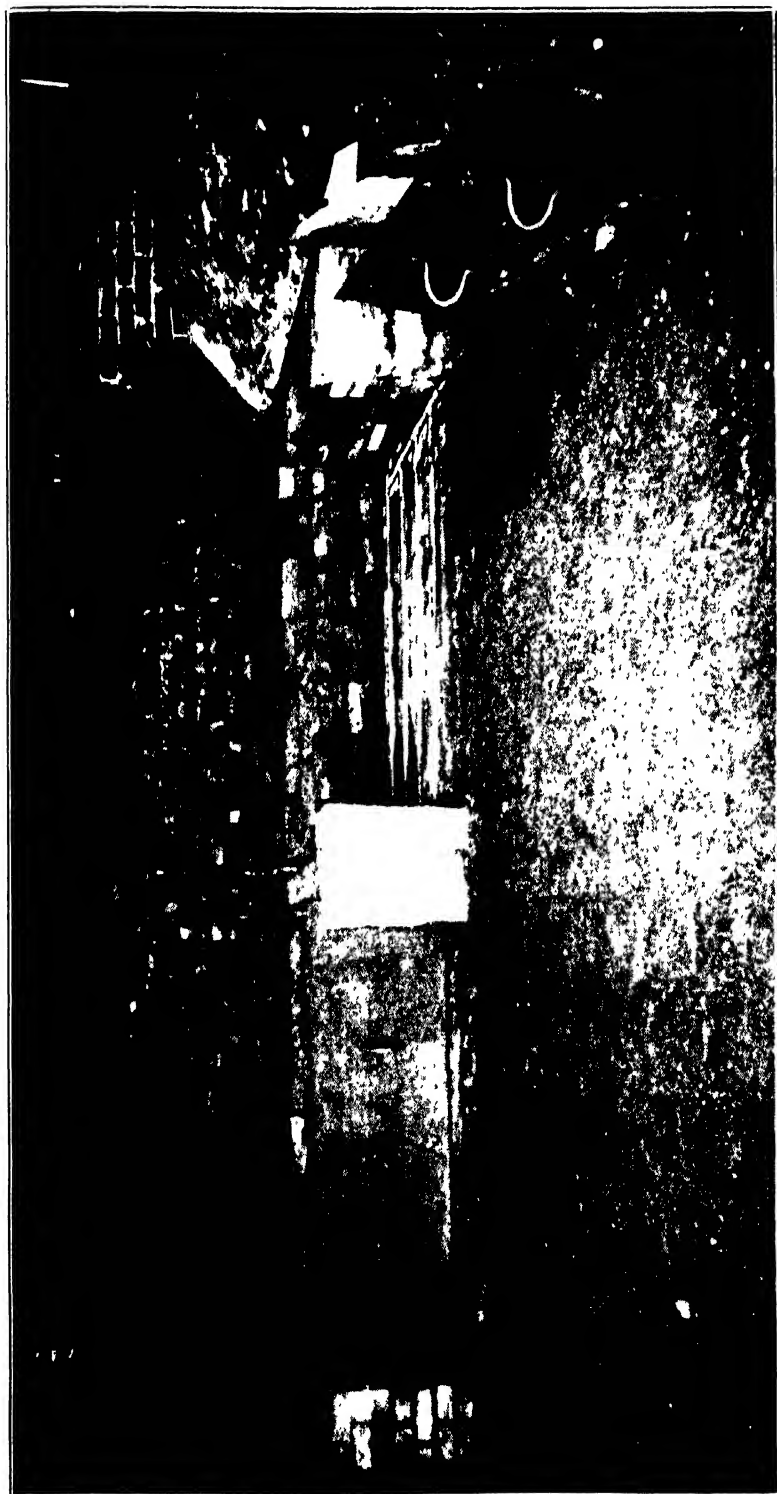


FIG. 2.—The Cheadle Royal Steaming apparatus.

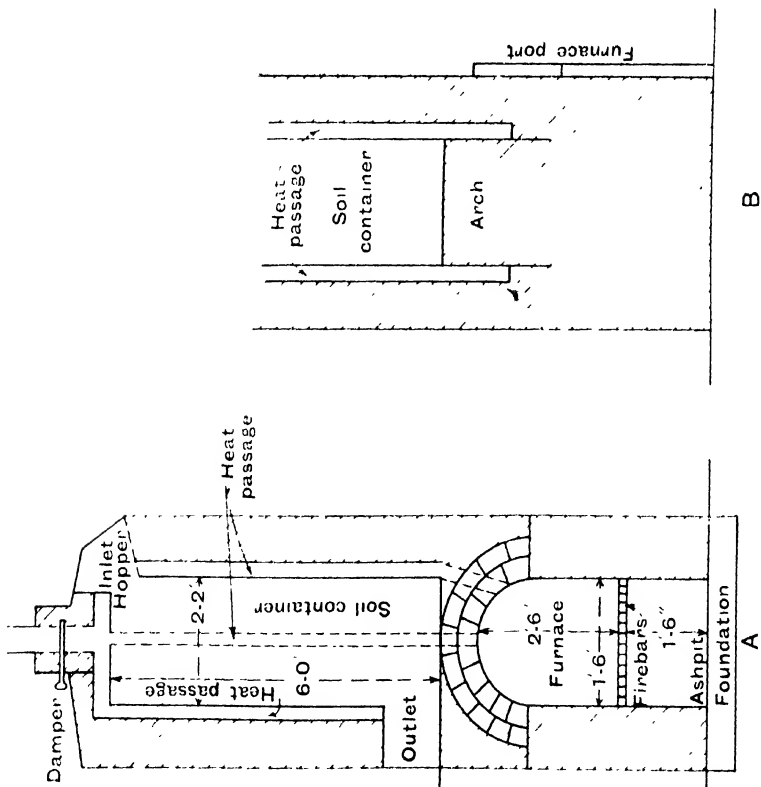


FIG. 3.—Baking oven : Holmes' type.

A. Section from side to side.

B. Section from back to front.

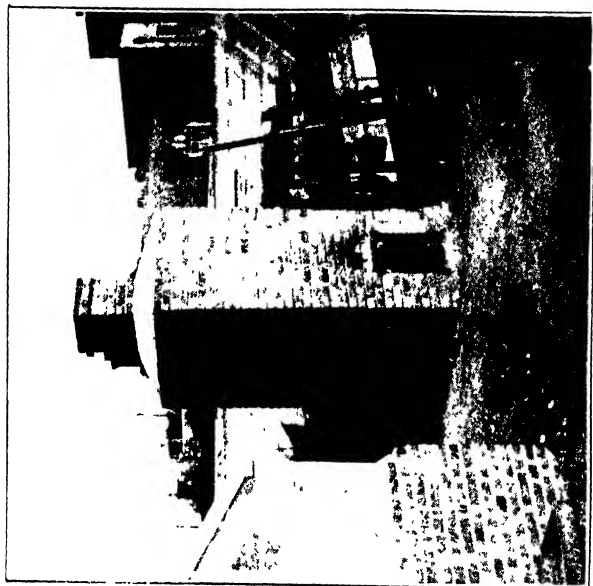


FIG. 4.—Baking oven : Holmes' type.
Exterior View : Showing furnace door.

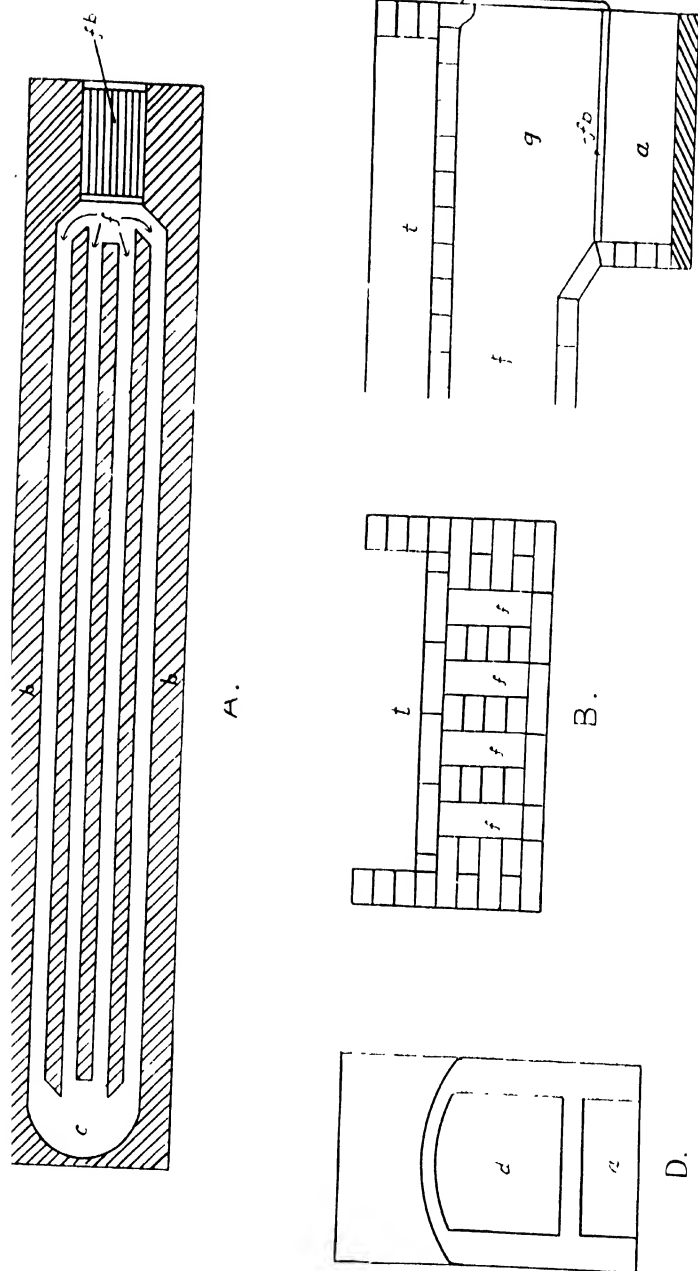
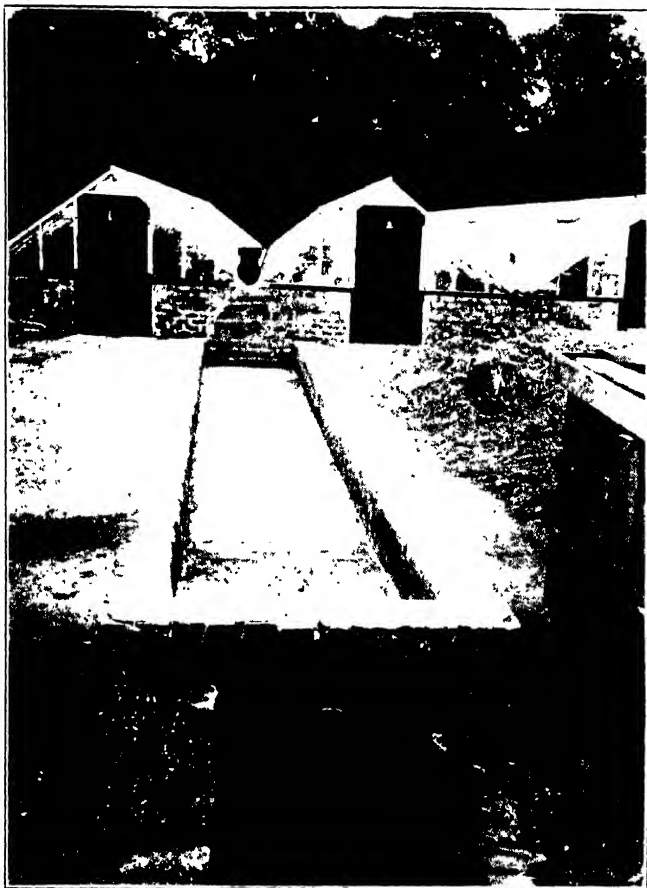


FIG. 5.—Diagram illustrating the construction of Mr. W. Priestner's modification of the Warburton Baking Apparatus.

A. Plan showing arrangement of flues *f* in relation to chimney *c*, firebox *fb* and surrounding brickwork *b*.
 B. Cross section showing flues *f* and soil trough *t*.
 C. Longitudinal section showing trough *t*, flue *f*, firebox *g* (firebox *fb*) and ashpit *a*.
 D. End of baker showing firebox door *d* and ashpit *a*.

(a)



(b)

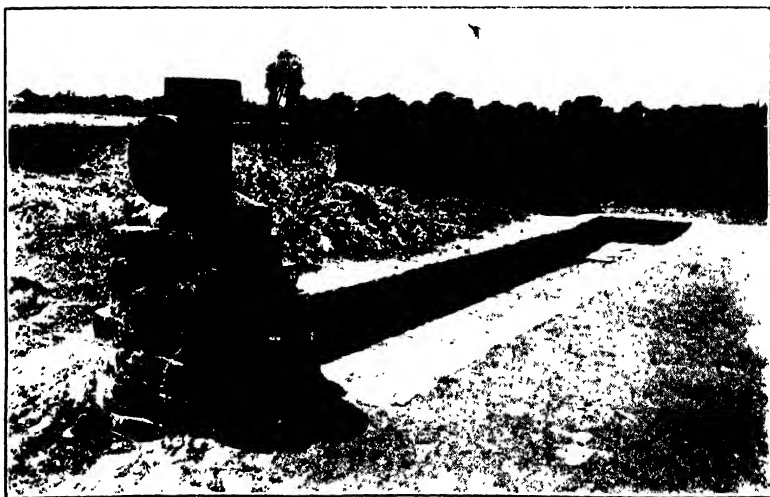


FIG. 6. —Baking apparatus on Mr. W. Priestner's Nursery, Northenden, Cheshire.
(a) From firebox end.
(b) From chimney end.

different angle, so that the steam may emerge in every direction. The best covering for the soil, while it is being treated, consists of old sacks, which keep in the steam and soak up the moisture.

Before use, the condensation-pipe valve on the grid should be opened, and the main valve opened right out. The intermediate valves should then be eased slightly to allow a small pressure of steam to clear out all condensation water in the pipes and grids, gradually turning on full steam to blow out any obstructions that may have blocked the small holes in the grids. It is sometimes necessary, before starting to do this, however, to prick out these holes with a steel pin. After use, always sweep out the beds quite clean, and blow some steam through the grids. Being under cover, the sterilizing process can be carried out during wet weather, thereby finding useful employment, and minimizing the cost of carting or wheeling which may appear prohibitive during fine weather."

The dimensions of the structure are such that each trough will hold one ordinary cart-load of soil, and time is saved by having two troughs; for one can be emptied and refilled while the other is being steamed. A uniform temperature of 210°-212° F. is obtained throughout the bulk of soil, and 40 minutes' steaming is sufficient to yield satisfactory results.

The above methods are thoroughly practical, and can be recommended to all who possess a source of steam at 60 lb. pressure, or who are willing to purchase the necessary steam boiler. A good second-hand boiler can often be purchased quite cheaply, and it ought to be possible to erect one suitable for the purpose at a cost of not more than £80.

For satisfactory results, the soil must be uniformly moist. If it is too dry, the steam blows through too quickly; and if too wet, it bubbles through in channels. In both cases, every particle of soil is not treated and imperfect sterilization results. The experienced grower can easily determine the correct moisture conditions, but, generally speaking, a soil sufficiently dry for potting purposes is in a suitable condition for steaming. In any case, it is best to err on the side of dryness. The soil should not be used for at least three or four weeks after being sterilized, as it has a tendency to check growth if used almost immediately.

Many devices have been invented by gardeners for the purpose of sterilizing small quantities of soil, and, while they are probably less efficient than those described above, they have proved helpful and as such are worth noting.

One such method calls into use an ordinary metal bin, such

as is used for storing wheat or manure, or as a receptacle for household refuse. Steam is introduced through a gas ring placed in the bottom, and protected by covering with a false bottom of perforated metal. The bin is filled with soil and the lid placed loosely over the top. This method proved quite satisfactory for 3 cwt. of soil, when a long factory thermometer was used to test the temperature of the soil at different depths. Uniform heating to 210° F. was obtained after 30 minutes, using steam at 60 lb. pressure, and steaming was continued for another 20 minutes.

Another method was described by Moore (3). For this purpose, an iron "copper," 18 in. wide at the top, 16 in. deep, and having a capacity of 10 gallons, was used. This was rested on a ring support to enable a fire to be built beneath it. A piece of strong sheet iron perforated with $\frac{1}{4}$ -in. holes was placed in the "copper," so that it just cleared a gallon of water in the bottom. Soil was placed in the "copper" over the false bottom, and the fire lighted below. After 60 minutes' boiling, the copper was removed and the soil turned out. This device is open to some criticism, but should be helpful in small gardens. It illustrates how the principles of steam sterilization can be utilized at a minimum of expense.

Two patented devices, at least, are based upon the principles involved in the preceding "copper" method, namely: the "Sterilatum" apparatus, sold by Jones & Attwood, Ltd., Stourbridge, and Dorey's Patent Steam Soil Sterilizer, sold by Leale, Ltd., Guernsey. Both can be obtained in portable form and consist of a chamber in which soil is exposed to steam generated from a water-bath below.

Mr. T. R. Bean, Vale, Guernsey, also has invented and patented a portable steaming apparatus, which consists of a steam boiler and steaming vessel mounted on a base fitted with wheels. The steaming vessel resembles a large autoclave and holds about 1 ton of soil. It is mounted in such a manner that it can be swung into a horizontal position for filling and emptying, and returned to the vertical position during steaming.

Baking.—The practice of burning the surface soil of fields and plantations, by igniting quantities of brushwood, turf and other dry materials, has long been followed in the East, and many gardeners can remember burning soil in shovels or trays over a fire in the days of their apprenticeship, so that the practice of baking is not altogether new. More recently, glasshouse growers have sterilized soils in trays resting on the top of tubular boilers.

Soil for baking should be uniformly moist and can with advantage be a little wetter than that suitable for steaming.

Probably the most reliable method is that devised by Holmes and incorporated in the Holmes' baking oven, the metal parts of which are sold by C. P. Kinnell & Co., Ltd., London. Figs. 3 and 4 illustrate the design of the apparatus. A metal box, with a centre flue, is built into a brickwork structure, so that the heat from a fire placed below the box passes up the centre flue and round the outside of the box. Care must be taken in erecting it to build the flues so that the draught is just sufficient to do the work. If the draught is too strong, the metal base-plate soon becomes burnt out. Soil is thrown into the box and heated for twelve hours over a slow fire. No part of the soil is further than 12 in. from a heating surface, and the bulk becomes uniformly heated to 210°-212° F. By inserting factory thermometers through the sides of the oven, with the bulbs in the soil mass, it is possible to determine the temperature at any given time, and with this precaution 6 hours' heating is usually enough. In the absence of any temperature guide, however, 12 hours over a slow fire produces satisfactory results. This method is popular in the Lea Valley and has been used with entire success at the Cheshunt Experimental Station during the last eight years. An oven, holding one cubic yard of soil, can be erected for a sum not exceeding £40 and soon repays its cost. An extra thick base-plate is an advantage, whilst a stout collar around the centre flue, at the point of contact with the base-plate, is a necessary protection against blows from a shovel used in emptying the oven.

Recently Shewell-Cooper (4) has described a baking apparatus, which he acknowledges to be "substantially similar to that designed and used by Mr. W. Priestner, of Northenden, Cheshire." Structures of this kind, however, appear to have been used in the Baguley and Timperley districts of Cheshire during the last twenty years, having been evolved from one originally constructed by Mr. John Warburton, of Timperley, about the year 1909. It seems desirable, therefore, that this type of sterilizer should be known as the "Warburton baking apparatus" in honour of the pioneer, who twenty years ago applied the results of scientific researches to his own line of business.

In the modified "Warburton baking apparatus" used by Mr. Priestner, a 2-ton load of soil is distributed evenly over the floor of a brick trough 22 ft. 10 in. long, 3 ft. 2 in. wide and 9 in. deep. The whole bed of the trough is so constructed as to

have a rise of about 1 in. in $2\frac{1}{2}$ ft. towards the chimney end, but the depth of the trough remains the same at both ends. Four brick flues, each $4\frac{1}{2}$ in. wide and 15 in. high, are built underneath the trough and serve to carry hot gases from the fire-box at one end to the chimney at the other. The roof covering the flues consists of ordinary bricks laid sidewise across the flue division walls, and serves as the flat floor of the trough; whilst the fire-bricks (supported by curved flat-sided iron bars) forming the arched roof over the fire-box are sloped slightly upwards towards the flues, and this same slope is maintained right along the flues to the entrance of the chimney stack. Immediately over the fire-box roof is a thin layer of fireclay. In constructing the flues, it is most important (in order to assist the draught) to cut away to a point the two outer corners of the outer flue divisions, at both the fire-box and chimney ends, and also to shorten the central division by about 3 in. At the same time, it is an additional advantage gradually to taper-up the entrance to the chimney into a cone-like formation by means of brickwork or fireclay. Figs. 5 and 6 illustrate the constructional details of Mr. Priestner's apparatus. A similar diagram relating to Mr. Shewell-Cooper's apparatus will be found in his paper (4). The trough is evenly filled with soil or potting compost, and if necessary this soil can be thoroughly sprinkled with water, and then covered with old sacking or similar material. In about 10–12 hours after starting the coke fire, the soil should have attained a temperature of about 205° – 210° F., but in practice this is not always reached, and the soil is therefore completely double dug at the end of 6–12 hours, re-watered if necessary, and then baked for a further 6–12 hours. The cost of materials used in building this equipment is given as £12.

Recent experience of this modified form of sterilizer, as used by Priestner and Shewell-Cooper, has shown that some difficulty may arise in maintaining a uniform temperature throughout the mass of soil during baking. Better and more equable temperature conditions are obtained in the original Warburton apparatus as used by Mr. George Tabner, of Timperley. For its construction is dug a trench, 20 ft. long, 4 ft. wide and 3 ft. deep, the bottom being given a gentle upward slope of about 1 in. in each $2\frac{1}{2}$ ft. from fire-box end to chimney. It is generally advisable to slope the bottom first, because an amateur may have considerable difficulty in constructing a gradient in brickwork upon a flat foundation. Bricks are first laid on the sloping bottom, and a 9-in. brick-

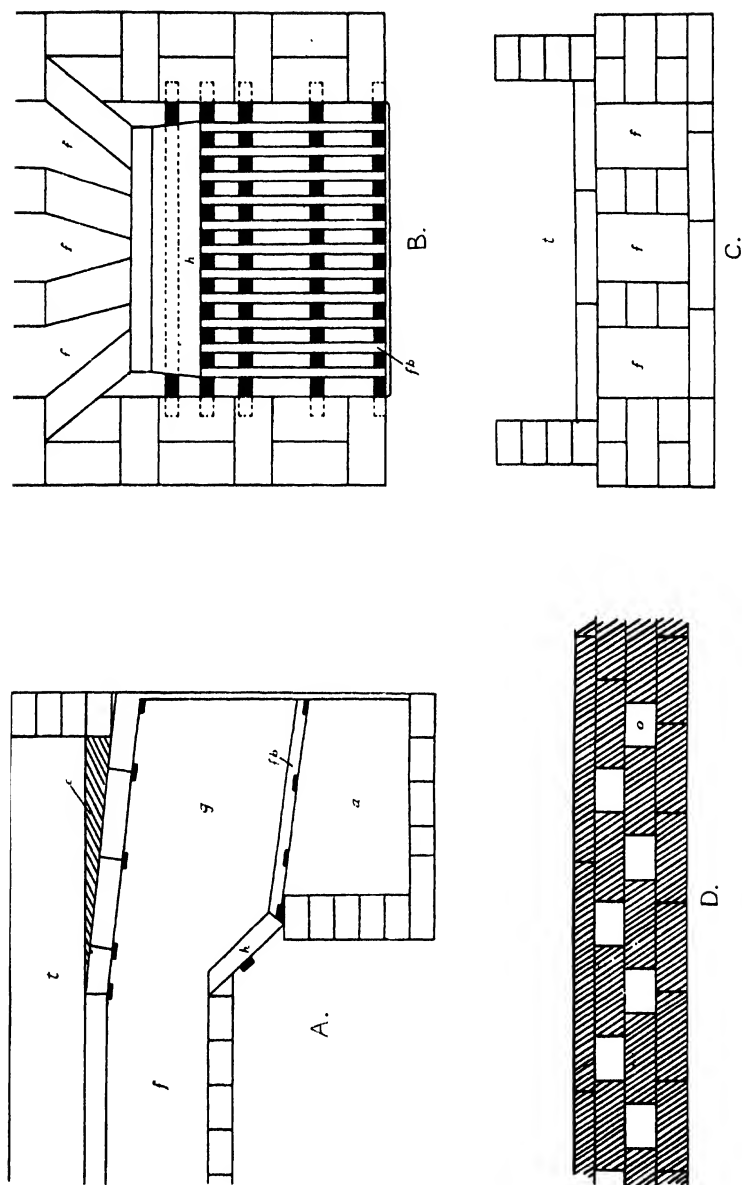


FIG. 7.—Diagram of the "Warburton Baking Apparatus" on Mr. G. Tabner's Nursery, Timperley.
 A. Longitudinal section showing trough *t*, flue *f*, firebox *g*, firebars *fb*, asphalt *a*, sloping tiles *h*, and fireclay packing *c*.
 B. Arrangement of firebars *fb*, sloping tiles *h* and flues *f*.
 C. Cross section showing trough *t*, and flues *f*.
 D. Wall between the flues showing openings *o* allowing communication between adjacent flues.

work lining is then constructed around the sides of the trench. Only three flues, each $6\frac{3}{4}$ in. wide, are necessary, the flue-division walls being built in three courses of bricks which (including the mortar layers) are exactly 11 in. high. The bricks of the lowest course are laid closely end-to-end, but those comprising the second and third courses are spaced about 3 in. apart so as to allow of inter-communication of the hot gases between the flues. Fire-tiles 23 in. by $11\frac{1}{2}$ in. are used for covering the flues and thereby form the floor of the soil trough, since ordinary bricks are much too thick and cannot withstand prolonged heating. The fire-tiles are allowed to rest partly on the inner edge of the outer wall and partly on the top of the flue division walls (see Fig. 7). The fire-box is about 2 ft. long, and is sunk so that the arched fire-brick roof, supported on a curved flat-sided iron base, is just level with the top of the flues. It, in turn, is lined with fire-bricks. The fire-box is set low down, and its floor consists of 14 firebars gradually sloped towards the flues, the entrance to which is as shown in the diagram.

At the back of the sloping firebars are placed several slightly sloping fire-bricks, which rest against the ends of the flues, and are supported underneath by an iron bar $1\frac{1}{2}$ in. wide, fixed across the back of the fire-box in a horizontal position. The heat is hereby directed evenly into the flues, and the inter-communication between the flues permits of uniform heating of the whole floor. The fire-bars (with plain ends, not patent-locking ends) are 22 in. long and are kept spaced $1\frac{1}{2}$ in. apart by means of small pieces of brick, and rest upon 3 broad cross-bars let into the brickwork.

To complete the apparatus, a chimney is built to collect the flue gases and, of course, the same precautions to ensure a good draught should be taken as in Mr. Priestner's apparatus. A damper for controlling the draught is absolutely essential for windy days. Fireclay is finally spread over the arched bricks forming the roof of the fire-box, up to the level of the tiles covering the flues so as to form a continuous bottom to the soil trough.

Mr. R. B. Swain, the Castle Nurseries, Kenilworth, uses a similar type of sterilizer, which was devised by his brother on the principles governing the construction of an ordinary baker's oven. Reinforced concrete is used in its construction instead of bricks, and the heating gases are carried along two flues each 15 in. wide and 15 in. deep. The trough is filled-up in the morning, and dug over at mid-day, when the half nearest the fire is cleared out, and replaced by fresh soil. The

fire is left burning till next morning, when the entire mass of sterilized soil is removed. The cost of the materials is given as £11.

Successful Sterilization.—When a batch of soil is badly contaminated with disease organisms and soil pests, sterilization must be thorough; success depends upon obtaining a uniform temperature of 210°–212° F. at every part of the soil, and on maintaining this temperature for a sufficient length of time to destroy any pests and diseases it may contain. If some parts of the soil are insufficiently heated, centres of infection remain, and from them disease organisms can spread with great rapidity through the rest of the soil. Considerable experience of practical soil sterilization in the glasshouse areas of this country has shown, without doubt, that for satisfactory results under all conditions, sterilization must be thoroughly conducted.

When considering the merits of any particular sterilizing device the following important questions must be asked :—

- (1) Does the method provide a uniform temperature of at least 210° F. throughout the mass in a reasonable time?
- (2) Does it turn out the soil in a condition suitable for plant growth?
- (3) What is the cost of constructing and working the apparatus?

Any apparatus which does not fulfil the first requirement is unsatisfactory, for while it may improve some soils it cannot be relied upon to destroy diseases and pests which cause so much anxiety and financial loss to commercial growers.

Steaming is undoubtedly the best method of sterilization and should be used whenever possible. The box and grid method, and that used by Falconer, can be recommended and, for ease of working, the second will probably make the greatest appeal to growers.

In the absence of a source of steam, growers would be well advised to consider the process of baking, but they should not be misled into sacrificing efficiency for cheapness. The baking oven of Holmes is reliable and efficient, and provides a uniform temperature throughout the mass of soil. It can be thoroughly recommended. Uniform heating has not been observed in bakers of the Cheshire type.

The writer's thanks are due to Mr. A. Falconer, of Cheadle, for information regarding the Cheadle Royal Steaming apparatus; to Mr. G. Tabner, of Timperley, for information

concerning the original "Warburton baking apparatus"; to Mr. W. Priestner, of Northenden and Mr. R. B. Swain, of Kenilworth; to the Editors of the *Gardeners' Chronicle* for permission to publish Fig. 2, which originally appeared in their publication (2); to Mr. E. Holmes Smith, of Manchester University, for Fig. 6 and for his kind assistance; and to Mr. W. Corbett, of the Cheshunt Experimental and Research Station for preparing the diagrams.

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SUGAR BEET TOP SILAGE

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THE great value of sugar beet tops and crowns is gradually becoming recognized in this country. Many farmers feed them when wilted to cows, cases being on record in which up to 70 lb. per head have been fed daily with good results.

A usual proceeding is to throw out a cartload of tops on to a pasture daily, for a herd of 20 to 30 cows. In view of the occasional cases of scouring which have occurred when a heavy ration of beet tops has been fed, it is worth while to follow the advice of Kellner and Woodman and add $\frac{1}{2}$ lb. of ground chalk or carbonate of lime per 300 lb. of tops. This is equivalent to about 1 lb. of carbonate of lime per cartload. The ground carbonate of lime may be sprinkled on the moist tops. Beet tops have also been very widely used for folding sheep, and are generally recognized as being excellent for this purpose.

In Norfolk 25 acres of sugar beet tops kept 300 ewes from the middle of November to the middle of February, being equal in value to 15 acres of turnips.

In one case in Suffolk 4 acres of beet tops kept 240 sheep for 10 days, which confirms Johnson's view* that an acre of tops may keep 90 to 100 ewes for a week when supplemented with a grass run. When sugar beet first became popular in this country, the tops were frequently ploughed in as manure. In view of the fact that a large proportion of their value as

* S. T. Johnson, Roy. Agric. Soc., Occasional Notes, June, 1928.

food is due to the sugar they contain, which is of no manurial value, it is unlikely that this proceeding is sound economically. On light land some hold the view that the benefit to the land is greater when the tops are folded with sheep, than when they are ploughed in.

On heavy land, at Saxmundham Experimental Station, it was found by the writer that where the tops were ploughed in on part of a field, and carted off on the other part, the succeeding crop of barley was superior on the "ploughed in" part to the extent of 2 bushels of grain and 4 cwt. of straw per acre, which is distinctly less than was anticipated.

It would appear, therefore, that it is sound policy economically to utilize the tops as far as possible as food for stock, since they have far greater value for this purpose than as manure.

It not infrequently happens, however, especially where a considerable area of beet is grown, that it is impossible to utilize all the tops before decay sets in. In these circumstances some method of preservation is desirable. Experience in Suffolk has shown that, provided certain precautions are taken, they can be made into silage with quite satisfactory results.

The following is a brief account of the results obtained on certain farms where this method has been tried.

Manningtree.—On the farms of Messrs. J. R. Keeble & Son, Brantham Hall, Manningtree, sugar beet top silage has been successfully made during the past three years.

During the winter 1926-27, 9 acres of a good crop of tops were made into silage, probably about 72 tons in all. The clamp was made on the level, no excavation being made. It was 12 yards long and 4 yards wide and an average height of 1 yard when settled. The clamp took two days to make. The tops were thrown together before the sugar beet were carted off the land so that as little earth as possible got amongst them. They were not very wet when carted. Potato tops were put on the top of the clamp, also wet straw to keep out soil when earthed. They were earthed up the next day, 9 in. of soil being put on. The angle was 60 deg., so that the earth would only just stop on. The silage was fed to the cows by being thrown out on to a meadow, and was eaten in preference to green savoy. It had a nice "fruity" smell which, however, got more objectionable when exposed to the air for a time.

In 1927-28, a similar proceeding was adopted, the silage being fed to fattening bullocks and cows, with good results.

In 1928-29, Messrs. Keeble had five clamps, all made on similar lines, i.e., the clamp was made on the level, without excavation, being earthed up like a mangold clamp. The silage was fed to in-calf heifers, about 3 stones per head daily, with hay. Fat bullocks fed on it killed well. The cows were largely fed with it, and did quite as well on it as on the raw tops. Even pigs and an old mare ate it well. Mr. Keeble likes to throw it out on a meadow so that the animals can pick it over. He fed it frosted. He considers that a load of beet top silage is of more value than a load of mangolds.

The silage was fed during winter, before the grass began to grow in spring.

Felixstowe.—On the farms of Messrs. C. C. Smith & Sons, Walton Hall, Felixstowe, a clamp was made in the late autumn of 1927, some of the tops being frosted when put in. It was on the level and was earthed up like a mangold clamp. The result was very good silage, which was fed to cows, the milk of which was not tainted. Some of the silage was taken into the cow-shed.

In 1928-29, a pit was excavated about 2 ft. below the ground, the length being 60 ft. and the width 12 ft. This was filled and the heap of tops carried upwards to a height of 7 ft. above ground level. The filling was done about a fortnight after the beets were topped. They were then earthed up with 9 in. of soil. The whole sank until there was about 2 ft. 6 in. depth of silage. The soil was a light loam. The resulting silage was of fair quality, but not so good as the previous year, the smell being more objectionable. It is difficult to say what the reason of this was, but it appears possible that the surplus moisture did not escape as well as when the clamp was on ground level. The soil, although light, with gravel subsoil, is not perfectly pervious to water. No drainage was provided, but the bottom of the silo was always dry when the silo was opened.

The silage was fed to young heifers, and to two lots of cows. One of the herds of cows, which had been receiving oat and tare silage all the winter, ate it well; the second, which had not received silage before this season, did not eat it so well, but gradually got used to it. The feeding of the silage did not commence until the end of March, when the meadows had begun to show a little fresh growth.

Woodbridge.—Hollesley Bay Labour Colony, Hollesley, Woodbridge (Superintendent, Mr. H. Barton), made 22 acres of beet tops into silage during late autumn of 1928.



FIG. 1.—View of a sugar beet top clamp silo.

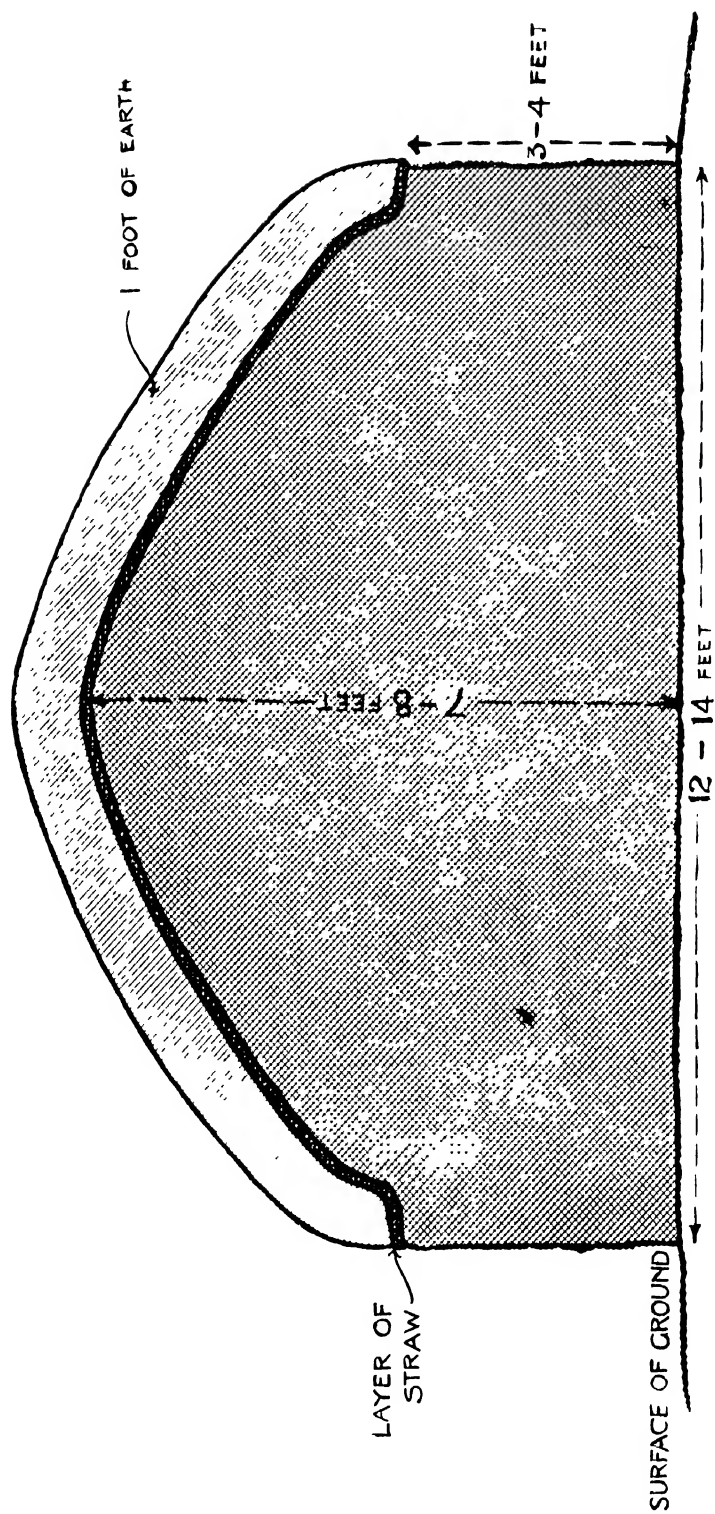


FIG. 2. Section of suggested clamp silo of sugar beet tops, at time of erection. The clamp will sink great

The soil is very sandy and a pit was dug 3 ft. deep, 30 yards long and 5 yards wide, no drainage being provided. This pit took 15 men 2½ days to dig.

It was filled with tops built up like a manure heap—when filled there was about 7 ft. depth of tops. These were covered with earth to a depth of 4 ft., all the earth being put back. and they sunk until there was 3 ft. thickness of solid silage.

This silage was fed to cows only. They would not eat it at first, but when accustomed to it would run for it. A good deal of grit got into it, and Mr. Barton proposes to cover with bracken before earthing up in future.

The silage was of very good quality, yellowish green in colour. Owing to scarcity of grass it was fed to cows all the past summer, and it was found that the cows would eat it well even when grazing the aftermath on a meadow.

Owing to the value of sugar-beet tops for feeding, both fresh and as silage, Mr. Barton states that he now grows only half the area of mangolds that he did formerly.

Eye.—Major R. Ridley, The Abbey, Eye, Suffolk, utilized a pit or trench which had previously been used for making trench silage from such materials as second crop clover, grass and tares. This pit is 15 yards long, 3 yards wide, 1 yard deep, and rectangular in shape. Drainage was provided although the soil is sandy. The tops were carted and stamped into the pit at the end of December, 1928, to a depth of 7 ft. from floor of silo to top of sloped roof; they sank until the silage was 3 ft. deep. Carting lasted for two days. The material was covered with about 1 ft. of soil. Major Ridley describes the silage as the best he has ever made. Twenty-four cows and heifers had a cartload a day regularly during February and March last. There was no scouring, and the cows went up in milk yield when given it in place of kale. The silage was thrown out on to a meadow, when horses as well as cows would eat it. There was practically no waste of material on the sides and top of the heap. Major Ridley proposes to make more sugar beet top silage this season. Mr. G. Flowerdew, of Eye, made quite good silage of beet tops in a disused ditch on light land.

Ipswich.—Mr. Ben King, of Rushmere, Ipswich, made a clamp of sugar beet tops early in January, 1929, the tops having been frosted earlier, although not actually frozen at the time of carting. The clamp was about 14 ft. wide and 15 yards long. The tops were heaped up to a height of 6 ft. but the heap sank to 2 ft. 6 in. Six acres of rather small tops

were put in, and as the land upon which the crop was grown was sandy the proportion of leaf to crown was less than usual.

The empty carts went over the heap lengthways while it was being made. The heap was covered with straw, some gorse being placed near the side to prevent the earth falling off. It was then earthed up to a depth of 1 ft., but a space of about 2 ft. was left on each side in the steepest place, without any soil. This left ample provision for drainage. After sinking had occurred this space was reduced to 1 ft. or less.

The straw was used to cover the tops to keep out soil. Excellent silage resulted, with very little waste—there was not more than a foot of waste on the sides and very little at the top and bottom.

The cows to which it was fed ate it well, and actually left marrow stem kale in order to eat it. Most of it was used up before the grass made any appreciable growth in spring, and all was finished by the middle of May.

Broxted.—On the Broxted estate of Messrs. R. & H. Paul (Mr. E. Gaymer, Agent), 14 acres of beet tops were put into a clamp in the autumn of 1928. The clamp was 6 yds. wide at the base, 17 yds. long, and 6 ft. high when sunk. Pipes were put in for drainage, and no portion was below the ground.

The clamp was not opened until April, 1929, when it was found to contain good quality silage, though an undue proportion of grit was present. The season was so far advanced that stock had already got a taste of spring grass and refused the silage. Mr. Gaymer has recently (September) commenced feeding this silage to young stock which refused it in the spring, but, in the present great shortage of feed, they now eat it readily.

Composition.—Two samples of silage, one of which was palatable and the other apparently unpalatable to stock, were sent to Mr. F. Hanley, M.A., of the School of Agriculture, Cambridge, and he reported upon their composition as follows :—

						Sample 1 (Palatable) Per cent.	Sample 2 (Unpalatable) Per cent.
Moisture	..	..	..	..	..	68.18	69.73
Fibre	..	..	..	..	..	1.44	1.50
Protein	..	..	..	..	..	1.46	1.56
Oil, fat, etc.	..	..	..	..	..	0.31	0.21
Carbohydrate	..	..	..	..	..	5.92	7.77
Ash	..	..	..	..	..	1.81	1.91
Insoluble residue (sand)	..	..	..	..	..	20.88	17.32
						<u>100.00</u>	<u>100.00</u>

Production starch equivalent per 100 lb.

(calculated in usual way)	..	..	5.6	6.8
Nutritive ratio (approximate)	..	..	1 : 6.7	1 7.7

In the case of sample 2, stock were not offered the silage until spring grass had made its appearance, and that may account for the fact that they would not eat it. Apparently a desire for beet top silage is an acquired taste; stock will eat it in winter, and when they have got accustomed to it will continue to eat it.

Mr. Hanley suggests the possibility that the unpalatable sample was ensiled under rather wetter conditions, fermentation being therefore somewhat restricted, the result being a rather sourer sample than the other more palatable material. This view seems to be borne out by (a) the smell which is less pleasant in the case of the unpalatable sample; (b) the higher percentage of carbohydrates, etc., in the unpalatable sample, showing less fermentation to have taken place.

The quantity of sand in both samples is worthy of note. Sample 1 has been consumed by a herd of cows without harm resulting.

It may be observed that Kellner gives 9.5 starch equivalent and 1.5 per cent. digestible protein for sugar beet top silage. The average figure for the starch equivalent of mangolds is 8, with 0.4 per cent. protein equivalent. It would appear probable, therefore, that a palatable sample of sugar beet top silage is of approximately the same feeding value per ton as average mangolds, but that the percentage of protein is higher in the case of the beet top silage.

Conclusions.—(1) It is evidently not a difficult matter to make fairly good silage from sugar beet tops, and this silage, although rather offensive in smell, is relished by most classes of stock, provided it is fed in mid-winter, and if a little time is given to them to get used to it. There is some evidence that once spring grass is available, it is much less appreciated and may be rejected.

This method of preserving the tops is quite satisfactory and may very well be adopted when it is impossible to consume them all in a fresh state.

(2) In collecting the tops there is no doubt that considerable care is necessary to prevent the admixture of an undue proportion of earthy matter. The tops should be collected in heaps or rows, before the sugar beets are carted off the field, and the cart-wheels should not pass over them.

(3) The silage may be made in a pit or trench, or on the surface of the ground, as a clamp.

When made in a pit or trench very complete drainage should be provided, even on sandy soil, owing to the large amount of moisture present.

Where a pit is not already available it does not seem worth while to dig one, as quite as good silage, with hardly any waste, has been made in simple clamps on the surface of the ground. In the case of tares and similar material, silage made in clamps has probably not been found so satisfactory as that made in pits or trenches. It must be remembered, however, that sugar beet tops contain more moisture than these crops, and they are made into silage at a time of year when there is very little drying. Hence the conditions for the two classes of materials are different.

A clamp about 14 ft. wide (fig. 2) on the surface of the ground, carried up as high as possible, the empty carts going over the heap lengthways while it is being made, the heap being then rounded off, covered with a layer of straw, to keep out soil, and immediately earthed over to a depth of 1 ft., appears to be a simple, inexpensive and satisfactory way of making sugar beet top silage. If cracks appear in the covering earth after settling they should be filled up.

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THE " SHAB " DISEASE OF LAVENDER

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SINCE the middle of the last century, wherever lavender has been cultivated on a considerable scale in this country for the manufacture of perfume, growers have been troubled by a serious disease in the crop. Large numbers of plants have been killed, and in some districts, indeed, the damage done has been so great that cultivation of lavender has been greatly curtailed or even discontinued. This trouble—commonly known as the " Shab " disease—has been attributed to such agencies as frost and lime deficiency, and also to a " white fungus at the roots." As the result of a scientific investigation of the disease, Brierley* in 1916 concluded that it was due to a parasitic fungus that attacks mainly the over ground parts of the plant and is called *Phoma lavandulae* Gab. During the years 1926-28,

* Brierley, W. B., "A Phoma Disease of Lavender." With two plates and numerous text figures. *Kew Bull. Misc. Inform.*, 1916, pp. 113-131.

the present writer, thanks to a special research grant obtained through the Ministry of Agriculture and Fisheries, was enabled to carry out a more extended investigation of the disease, especially in its field aspects. The Cambridge University Botany School formed the headquarters of the investigation, but it was found possible to devote special attention to a study of the origin, development and practical control of the disease through close contact made with commercial lavender plantations at Hitchin, some 26 miles distant. Plantations at Worthing in Sussex, at Ramsgate and near Canterbury in Kent, and at Long Melford in Suffolk, were also visited from time to time, and in some of them extensive experiments were carried out. The writer is greatly indebted to the owners of these plantations, without whose assistance the investigations would have been quite impossible. Thanks are also due to Mr. F. T. Brooks, of the Cambridge University Botany School, for his supervision of and interest in the work.

Symptoms of the Disease.—The first definite symptoms of " Shab " are to be seen at the end of May or the beginning of June, when certain of the young shoots turn yellow, wilt and die. Later, the disease extends downwards to the older parts, and ultimately the plant is killed. Fig. 1 shows a lavender plant suffering from the disease at an advanced stage, the general wilted appearance being very marked.

On young twigs that have been killed in this way, small black " dots " can be discovered with the aid of a strong magnifying glass. These are the spore-producing capsules (*pycnidia*) of the fungus known as *Phoma lavandulae*. It is often difficult to see these structures, since they are hidden amongst the hairs that clothe the surface of the stems. Spores from these pycnidia have repeatedly been used to inoculate healthy lavender plants, and infection with the disease has followed; thus Brierley's conclusion that the fungus that forms these pycnidia is the cause of " Shab " has fully been confirmed.

Damage to Lavender Resulting from Other Causes.—Any conditions that affect lavender adversely tend to induce symptoms that may readily be mistaken for those resulting from attack by *Phoma lavandulae*. Thus, lavender, being a native of the warm Mediterranean region, is very liable to be damaged by severe frost. This may kill the plants outright, whilst less severe frosts in late spring may cause the young shoots to turn yellow and wilt. Frost is especially liable to do harm if followed by wet weather, and recently-planted bushes are very frequently damaged in this way. Shading by trees adjoining the lavender

fields may also cause the plants to die back, and similar symptoms are seen when the crop is grown on a heavy, water-logged soil. Hence great care is necessary to distinguish between symptoms due to adverse environmental factors and those due to invasion by the parasitic fungus *Phoma lavandulae*.

Mode of Infection.—The fungus can invade a healthy lavender plant either at the point where the base of the leaf is attached to the young stem (*leaf axil*), or through any fresh wounds that may be present, such as those made when the crop of flowers is cut or when the plants are trimmed. On the other hand, the fungus cannot enter through old wounds. Once it has become established within the host, the fungus spawn (or *mycelium*) grows inside the stems and so reaches all parts of the plant, which consequently die. Under suitable conditions the fungus can infect healthy lavender plants at any time of the year, but it does so most readily either in the autumn, through wounds made during harvesting of the crop, or in the spring, through the leaf axils on young stems.

Experiments have shown that a long interval elapses between the time the fungus invades the plant and the first appearance of clear symptoms of the disease; and it is possible, therefore, for a plant to remain healthy in appearance for a time, although the fungus has become established in it. The length of this interval varies according to the time of year at which infection takes place, but it is seldom less than two months and may be as much as a whole year.

Spread of the Disease.—It is clear that if the branches of a lavender plant with the spawn of the fungus present within their tissues are used as cuttings, the new plants to which they give rise will be diseased from the start; and it is certain that the common way in which the disease has been spread in the past has been by the use of already infected cuttings of this kind.

It has been found that the spores are extruded in masses from the pycnidia most readily during rain; they may then be splashed from plant to plant, so that the fungus spreads gradually through a lavender field. The spores themselves are very small, and unless they are able to germinate and infect a plant almost at once, they cannot live for more than a day or two after they have been liberated. On the other hand, while still within the pycnidia they can remain alive for a long time; and living spores have been found in pycnidia on old twigs that were already becoming decomposed. Thus it follows that if lavender twigs bearing pycnidia are left about in a field



FIG. 1. Lavender plant affected with "Shah" disease. The disease is in an advanced stage, and only one shoot (in the centre) is still alive.

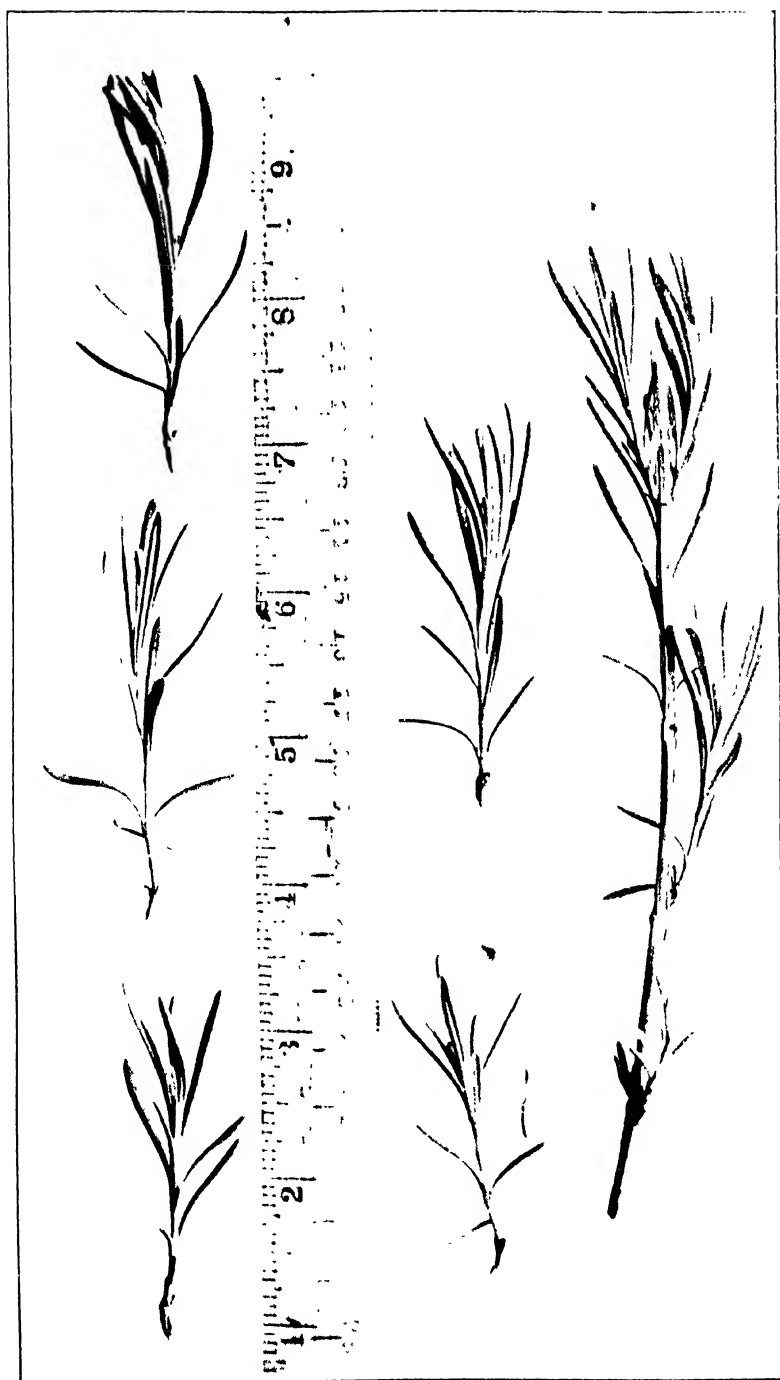


FIG. 2. The five portions of lavender nearest the ruler are small cuttings of the type recommended for raising healthy plants. Such cuttings can advantageously be taken from a twig such as that shown in the extreme right.

they may be distributed by such agencies as workmen, horse-hoes, or the wind ; and, after the pycnidia have been dispersed by one of these means, the spores may be exuded during rain and be carried to and infect healthy plants.

Growth of *Phoma lavandulae* on different Varieties of Lavender and on Other Plants.—Plants of every variety of lavender that could be obtained have been inoculated with *Phoma lavandulae*, and it has been found that most of them are susceptible to the disease. A notable exception is the variety " Dwarf French," which seems to be immune. This variety, however, is stated to be of no use in the manufacture of perfume. The species *Lavandula dentata* (which can be grown only under glass) is also immune from the disease.

The fungus has been found growing on *dead* stems of White Goosefoot (Fat Hen, or Dung Weed, *Chenopodium album*), an all too common weed in most lavender plantations. The fungus derived from this source has been used to inoculate healthy lavender plants, and has been found to give rise to the disease in the same way as does the fungus from diseased lavender itself. The fungus, however, has not been found growing on *living* plants of *Chenopodium album*.

Control Measures.—Since the only variety of lavender that is immune against " Shab " attack is of no value in the manufacture of perfume, the disease cannot be controlled by growing resistant varieties. Other methods must therefore be adopted.

(1) No single remedy that can prevent attack by " Shab " disease has been discovered, but there are several promising ways in which the problem of control can be approached. It must, however, be made clear at the outset that nothing of any practical value can be done to cure the disease in a lavender plantation in which the disease has become well established. The best course to adopt with such a plantation is to burn all the plants as they stand. This is preferable to digging up the plants before burning, as stray twigs bearing pycnidia do not thus become scattered over the soil. After the crop has been burnt, all the roots should be removed, and a crop of lavender should not be planted on the same ground for at least a year.

(2) As soon as a diseased plant is seen in an otherwise healthy plantation it should be removed with care and burnt. Further, the four plants adjoining the diseased one should be treated

similarly, since the fungus may already be established in them in a latent condition, and they would consequently succumb to the disease as soon as the fungus developed. In the " Golden Age " of lavender cultivation in this country it was the custom of many growers to " rogue " the plants in this way, thereby keeping the disease in check. The practice is well worth reviving.

(3) The growth of weeds among the lavender bushes weakens the latter and renders the plantation unsightly, consequently every effort should be made to keep the lavender fields in clean cultivation, special care being taken to keep down *Chenopodium album*, on the dead stems of which *Phoma lavandulae* may tide over unfavourable periods.

(4) Large-scale experiments have been carried out in which the lavender plants were trimmed drastically with shears early in March, the trimmings being carefully collected and burnt. This treatment prevents the disease from spreading, since not only are young twigs bearing pycnidia removed, but the young parts of the plant in which the fungus may be newly established are also got rid of. In one large-scale experiment of this kind, 3,443 bushes were grouped into a number of plots, the plants in half of them being trimmed drastically with shears and the remainder being left untreated for comparison. At the end of the following summer it was found that whereas 887 plants, in addition to those already affected at the start, became diseased in the unclipped plots, only 425 additional plants became diseased in the plots that had been trimmed. It is thought that if the clipped plots had not been intermingled with the unclipped ones the result would have been even more satisfactory, since the pycnidia on the unclipped plants must have served as the chief source of infection of the clipped plants. Spring clipping has the additional advantage that the bushes are kept in good shape, and the flower heads are remarkably large and fine. The chief disadvantage is that, if late spring frosts follow the clipping, the time of flowering may be delayed by about three weeks. However, this is not a serious drawback if the flowers are to be distilled for perfume.

(5) When lavender was first grown in this country on a large scale, it was the custom to plant the bushes further apart than the 3 ft. which is customary at present. If plants are set out 4 ft. apart in each direction they grow much better, and spores are not so liable to be splashed from one plant to another.

(6) Cuttings should be selected only from healthy plants and should be extremely small. The five cuttings shown in Fig. 2 illustrate the size the cuttings should be, i.e., not more than 2 to 2½ in. long. Small cuttings consisting only of "green wood," taken from a twig such as that shown on the right of the figure, have been found to root more readily than larger ones, if started in light soil in a warm glasshouse. If a glasshouse is not available, the cuttings may be raised in cold frames, or even in open ground in a sheltered place; but in these circumstances their development is slower. The practical details of this method of raising cuttings must depend on the facilities at the disposal of individual growers.

Summary.—(1) An extensive investigation of the "Shab" disease of lavender has been made at the Cambridge University Botany School and in commercial lavender plantations.

(2) The cause of the disease has been proved to be the parasitic fungus *Phoma lavandulae* Gab., thus confirming the conclusion previously reached by Brierley.

(3) The symptoms and mode of development of the disease in the plant are described.

(4) Symptoms similar to those of "Shab" have been found to be due sometimes to adverse environmental conditions.

(5) *Phoma lavandulae* has been found to invade lavender plants either through the leaf axils on young stems or through freshly made wounds.

(6) The disease becomes spread over wide areas by (1) the dispersal of small portions of diseased stems or leaves bearing pycnidia; (2) raising cuttings from diseased plants; and (3), locally, by the splashing of spores from plant to plant by rain.

(7) While most varieties of lavender are susceptible to the disease, the variety "Dwarf French" appears to be immune from attack, but this variety is useless for perfumery purposes.

(8) *Phoma lavandulae* has been found growing saprophytically on the dead remains of White Goosefoot (*Chenopodium album*), and successful inoculations of lavender have been made with the fungus derived from this source.

(9) Measures by which the disease may be controlled are described.

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MANAGEMENT OF FARM HEDGES—II

(Concluded)

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Hedge Plants.—Of the various species of shrubs and plants of which hedges are composed, the White Hawthorn is the most useful, as it is adapted to most soils. Being a native of Great Britain it thrives well, and if correctly managed forms a strong fence against all kinds of stock. It is very useful as a shelter on grazing lands, owing to its fairly quick growth. It makes most progress on heavy soils that have a subsoil of clay.

Blackthorn is often grown and is very suitable on damper soils, although inferior to the Whitethorn on account of its tendency to throw suckers from the roots instead of growth from the stumps when cut. Its branches are less rigid, but are very easy to manipulate when plashing. It is a useful plant to use for renovating gappy hedges. Special care should be taken in handling, as the thorns appear to be more venomous than those of the Whitethorn.

Holly will grow in almost any but wet, retentive soils. It makes slow but considerable growth, and is useful for planting gaps, as it will thrive in the shade, even under trees. It is advisable to plant in May or September, and prune or cut in the spring, when there is little fear of late sharp frosts. Though a slow grower, it eventually makes a very dense hedge and an effective barrier.

Crab, elm, hazel, hornbeam and maple are often used in hedgerows. All are inferior to the Whitethorn for various reasons, the chief being that they are thornless and easily pulled about by stock. Ornamental fences are often composed of privet, beech, holly and yew. The last named is poisonous and should not be planted where cattle are grazed or likely to roam. Trimmings of the yew should be carefully collected and burnt without delay.

The poplar and willow, although inferior to any of the former mentioned, are useful on wet, boggy lands where other species will not thrive. They are propagated by means of cuttings about a foot long, which are planted along the line of the intended hedge. Hedges of willow may be made by planting stakes about four feet in length crosswise in the form of the letter X. They require frequent trimming after the first year, and can be improved by interlacing the shoots between the stakes used to form the hedge.

The hawthorn is propagated from the seed commonly known as "haws," which are gathered in October, laid down to dry, thinly at first to prevent heating, then mixed with fine soil or sand and placed in a heap to rot. The mixture should be about one-third sand or soil and two-thirds seed. This is clamped in a similar manner to potatoes until the following October, when it will be required for seed. A damp soil is most suitable for raising the young plants from seed. It should be well prepared by digging deeply with a fork, and dressed with good rotten farmyard manure. This is best done some time before sowing, to allow the soil and manure to be thoroughly incorporated. The seed can be sown in drills about 1 in. deep, and of sufficient space between the drills to allow for hoeing. They may be drawn in the usual way with a rake or three-cornered hoe. Both the seeds and soil taken from the heap should be evenly distributed along the drills, care being taken to break up any lumps that are observed. The seed is then covered in with a rake. It may be sown in the early spring if desired, but usually the autumn-sown seeds make stronger plants. It is very important to destroy all weeds by hoeing while the young plants are growing, and it will be advisable to hand-weed the rows. The plants should be ready for transplanting the following autumn. They are then known as "quicks."

A bed is prepared similar to the seed bed, and the young strong plants or quicks are placed in trenches about 8 in. deep, dug the length of the bed, and spaced about 3 in. apart in the trench. Soil should be carefully placed to the roots and trampled slightly. The rows are spaced about 18 in. to ensure the bed being cleaned. Long straggling and damaged roots must be cut with a sharp knife before planting. After planting in this nursery the only attention required is to keep the bed free from weeds until the quicks are large enough to use for the permanent fence; this usually takes about two years. As it takes about four years to rear quicks suitable for planting from seed, it will, perhaps, be advisable to purchase from nurseries when it is intended to lay out new hedges or plant up gaps in the hedgerows. Quicks should be planted as soon as possible after arrival from the nursery, or the roots may be damaged by heating through being tied in bundles.

Privet can be propagated by means of cuttings about a foot long, planted firmly in the ground either in the autumn or spring, and removed the following winter to their permanent position in the fence for which they are required.

Hedge Scotching.—This method of treatment, sometimes known as “buck heading,” is one that can follow up plashing after the hedge has made a few years’ growth.

It is a means of lowering hedges that still have a good bottom and are stock-proof. In carrying out the process a considerable amount of the brush, or outer branches, is removed from the sides and top of the hedge; it is important, therefore, to do this work only on hedges that have sufficient material at the base to ensure a stock-proof barrier when completed. An ideal hedge for the work is one that has been plashed, and made about eight years’ growth. In this case the layers are in a good condition, and assist in making a stock-proof hedge of the desired height.

The type of work depends upon conditions to a great extent. Hedges required as stock-proof barriers, situated between grazing fields, can be scotched successfully only when layers still exist from the previous plashing, or when there is an abundance of growth on evenly spaced “stools.” A suitable height for this type of hedge when completed is about 5 ft. Fences between arable and grass may be scotched when slightly weaker at the base, if sufficient brush exists on the grazing side; only the arable side and top of the hedge is removed under these conditions. It is often considered advisable to lay branches in, and fasten at the back of stems already cut if small gaps exist.

Arable land hedges should be scotched at a period when stock are not likely to be grazed. This will enable them to fill in by the time they are required to be stock-proof when crops are “eaten on.” The height under these conditions need not be more than 3 ft.

Tools used for the work consist of a strong slasher, a hand bill, rake, fork, and sharpening stones. It is important that the cutting tools be perfectly sharpened. The cutting should be done with a clear cut, by cutting in the direction that the stems are growing. This will allow water to drain off quickly, and prevent “die back” caused by the stems rotting through continual moisture.

It is important that the stems be severed at various heights, to promote new growth at different positions on the sides of the hedge, from the base upwards. The top should be cut perfectly level at the desired height, and the hedge when completed should form the shape of a capital letter A, which results in a wide base and narrow top. The object is to allow all new shoots plenty of air to encourage growth. The work

should be done during the autumn or winter months. The new growth forms in the spring of the year, making good progress during the summer. Until one becomes thoroughly efficient, it is a good policy to cut lightly, and it is sometimes necessary to go over a length a second time to ensure a level finish. After this treatment the hedge may, if desired, be trimmed annually or twice a year, as long as the base remains in good condition, or it may be allowed to grow on again for the purpose of shelter if desired. When hedges are being scotched it is an excellent plan to remove all rubbish and weeds—dead leaves, elders, briars, etc.

Hedge Brushing or Trimming.—Hedges that have been “plashed and scotched” may be given a very neat appearance by the treatment mentioned above. It is a fairly simple process, but one that is often very badly done. As this work is carried out at a period when there is considerable growth of grass and weeds around the base of the hedge, it is advisable to cut these with a sickle or scythe. If time permits, it is advisable to cut twice annually, in July and September. It is also very important that the top of the hedge be trimmed level, and the sides should represent in shape a capital letter A. This will ensure an abundance of new growth up each side of the hedge. Should the hedge be rendered uneven by previous inferior workmanship, one should level it by hard cutting through the lumps, and light cutting over the hollows, until an even surface is secured. Care should be taken to maintain this even surface by continually cutting through at the place each time the hedge is trimmed. By taking this precaution, hedges will become firm and stand up to the cut, thicken out, and it will ensure a longer period for successful trimming. A light type of slasher is used, which, needless to say, must be perfectly sharp. It is advisable when cutting one year's growth or under, to cut with a downward stroke. This will cause the tender shoots to lean and grow towards the base of the hedge. The result is that the bottom of the hedge is in a better condition for trimming for a longer period. It must be remembered that downward cutting can only be done on tender stems, or shoots of one year old or under. Over that age the growths become hardened, and should be cut in the direction they grow to prevent splitting and ensure a clean cut. Strong thorns or twigs of an annual trimming should be collected and burnt. If the hedges are trimmed twice, the tender shoots wither, and little remains after a few hot days. Hedge brushings are useful as foundations for ricks and coverings for root clamps.

REPORT OF THE RESEARCH AND EDUCATION DIVISION, 1927-28

THIS report, which has just been issued,* gives an account of the Ministry's schemes of research and advisory work, and agricultural and horticultural education in operation in England and Wales in the financial year 1927-28. In presenting the report, Mr. H. E. Dale, C.B., Principal Assistant Secretary, expresses the hope that it shows that, within the limits imposed by financial stringency, the Ministry, and the authorities whom it aids, continue to do work of a high value to agriculture.

Research.—The report deals at some length with research work in relation to Empire problems and claims that the most striking development in the year under review was the recognition that agricultural research is a common interest of the first importance to the whole Empire. Reference is made to the first Imperial Agricultural Research Conference which was held in London during October, 1927, and it is reported that eight new Imperial Bureaux for the collection and interchange of scientific information have been established as one result of this Conference. It is satisfactory to note also that the problem of providing an adequate supply of trained research workers to meet Empire requirements is being tackled.

Work of an Imperial character at research institutes is being aided by grants from the Empire Marketing Board. In respect of the academic year 1927-28 these grants, which are administered by the Ministry, amounted to £72,490 for capital expenditure, and £13,348 for recurrent expenditure, as compared with approximately £23,000 (capital) and £16,500 (recurrent) for the previous year.

Mention should be made of the generous benefaction of £700,000 offered by the International Education Board (Rockefeller Foundation) to Cambridge University on condition that the University raises about £500,000. Part of this fund, to which the British Exchequer and the Empire Marketing Board have each agreed to contribute £50,000, will be devoted to the development of research in agriculture and allied sciences.

Only the briefest reference can be made in this short review to the normal work of the agricultural research institutes.

* Ministry of Agriculture and Fisheries: *Report on the Work of the Research and Education Division for the Year, 1927-28*. Price, 3s. net. His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. The previous report, for the year 1926-27, was reviewed in this *Journal* in October, 1928, pp. 644-648.

A sum of approximately £150,000 was paid in respect of each of the academic years 1926-27, 1927-28, 1928-29, in the shape of "block" maintenance grants in aid of this work, the results of which reach the farmer through the medium of leaflets, articles in popular journals, and lectures and advice by the staffs of local authorities, colleges and advisory centres. Mention is, however, made in the report that direct contact between research workers themselves and farmers has been established as a result of a scheme (in which the Ministry has the co-operation of the National Farmers' Union) whereby lectures are given by the research workers to meetings of farmers organized by the county agricultural education staffs: 117 such lectures were given in 1927-28.

The report states that there is a growing appreciation amongst farmers, horticulturists, &c., of the services rendered by the local specialist advisory organization, and an increasing call for such services throughout the country. In respect of the academic years 1926-27, 1927-28, and 1928-29 grants from the Development Fund totalling £59,250, £60,110 and £61,660 respectively were made to the fourteen provincial advisory centres (universities and colleges) in aid of this work. The report deals in some detail with the different classes of specialist advisory work in such subjects as entomology, mycology, economics and marketing, dairy bacteriology, agricultural chemistry and veterinary science.

Post-graduate research and agricultural scholarships, travelling research fellowships and special research grants, were awarded during the year on the lines laid down in previous years.

The report also contains a section dealing with miscellaneous research schemes, *e.g.*, flax growing, foot-and-mouth disease, testing of agricultural machinery, grassland investigations, agricultural meteorology, sugar beet, &c.

Agricultural Education.—The report contains a brief but interesting historical sketch of the development of the national system of agricultural education, to which is linked up an account of the activities of the year 1927-28. The system is said to be gradually settling down on definite lines, although it is recognized that in certain directions there is room for improvement, *e.g.*, adequate veterinary advice and instruction, a more comprehensive form of training for women for rural life, and the agricultural education of boys and girls from fourteen to sixteen.

Liverpool University is proceeding with its scheme for the

provision of new buildings for teaching and research in veterinary science, towards the cost of which the Ministry has promised a grant of £15,000 on a £ for £ basis. Reference is also made in the report to the fact that the question of the rebuilding of the Royal Veterinary College has been under consideration by a Departmental Committee.

Up to March 31, 1928, the bulk of a capital grant of £26,500 was paid by the Ministry in aid of extensions to the Midland Agricultural and Dairy College, Sutton Bonington, including a new women's hostel and dairy.

As an indication of the growing importance of women's agricultural education, it may be noted that the Ministry has promised to contribute £ for £ up to a maximum of £5,000 to enable the governors of Studley College for Women to purchase the College freehold. Moreover, the College is now in receipt of an annual maintenance grant from the Ministry. A new botanical laboratory was also provided during the year in question at the Swanley Horticultural College for Women. The progress made by these two women's Colleges is regarded with satisfaction.

"Block" maintenance grants amounting to £52,900 were paid to university departments of agriculture and agricultural colleges in respect of the academic year 1927-28, compared with £50,930 for the previous year.

As regards the activities of local authorities, mention is made in the report that during the year under review two new Farm Institutes were formally opened, one at Plumpton (East Sussex) and the other at Pibwrlwyd (Carmarthenshire). Reference is also made to the new institute at Borden, Kent, which formed the subject of an article in last month's (September) issue of this JOURNAL.

The annual maintenance grants paid to local authorities in 1927-28 amounted to over £210,000, whilst capital grants amounting to £16,674 were paid to these authorities in aid of capital expenditure on the establishment or extension of farm institutes, &c.

The educational work of local authorities, as distinct from advisory activities, is slowly growing, and a satisfactory feature is the increasing facilities that are being provided for instruction in manual processes designed to improve the skill of the farm worker.

During the year under review, local authorities awarded 1,460 scholarships, to a total value of over £17,000. The Ministry's own scheme of scholarships for the sons and

daughters of agricultural workmen and others continues to show satisfactory results : 110 such scholarships were awarded in 1928, making a total of 841 awarded from the inception of the scheme up to the end of 1928.

The report records also the progress of the work of local authorities in dairying education. The clean milk campaign continues to progress and during 1927-28 there were clean milk competitions in 41 counties embracing 1,144 competitors, who between them owned 31,727 cows, this last figure being upwards of 3,000 in excess of that for any previous year.

Rapid progress is reported in the educational work of local authorities in regard to poultry and other small livestock. Reference is made to the educational and research work and experiments carried out at several centres under the National Poultry Institute scheme. This scheme, which is being aided by the Ministry, may now be regarded as in full operation.

Horticulture.—The report on horticultural education stresses the value of the demonstration and trial plots laid down by county authorities for the benefit of commercial growers. During the year under review there were about 170 such plots in England and Wales, and in addition 116 demonstration allotments had been provided to meet the needs of allotment holders.

An interesting account is given of the progress of the investigation into celery diseases conducted by the staff of the Midland Agricultural and Dairy College. It is stated that producers in important celery growing areas have already derived great benefit from the results obtained.

Interesting details are given of the Ministry's schemes for the inspection of growing crops—potatoes, strawberry plants and blackcurrant bushes. Emphasis is laid on the importance of these schemes from the commercial point of view in helping growers to obtain reliable stocks for planting, and from the educational point of view in assisting growers to identify rogues in their crops.

The Ministry undertakes the issue of all official certificates necessary to secure the entry into other countries of plants and other horticultural produce from England and Wales ; and as regards potatoes it may be noted that certificates in respect of nearly 24,000 tons were issued in 1928.

Some account is also given of the administration of the Destructive Insects and Pests Acts with particular reference to the Importation of Raw Cherries Order of 1928 and the Wart Disease of Potatoes Order of 1923.

SALE OF ALL-ENGLISH WHEAT FLOUR UNDER THE NATIONAL MARK

THE Minister recently appointed a National Mark Wheat Flour Trade Committee to consider applications for permission to use grade designation marks prescribed by regulations made under the Agricultural Produce (Grading and Marking) Act, 1928, in connexion with all-English wheat flour. The committee will make recommendations to the main National Mark Committee, and advise the Ministry and the National Mark Committee generally as to the use of such marks in connexion with all-English wheat flour.

The members of the Committee are : Dr. A. E. Humphries (Chairman), Mr. J. G. McDougall and Mr. A. H. Hobley (millers), Captain E. T. Morris, J.P., and Alderman E. W. K. Slade, J.P., C.C. (producers), Mr. F. Nevill Jennings, Mr. William Hasler and Councillor H. Williams (representing the baking, distributive and retail interests).

The Secretary of the Committee is Mr. B. A. Tyson, of the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

The Committee have considered applications for enrolment as authorized millers and packers under the Scheme, and have recommended the issue of certificates of authorization in 68 cases, distributed as below in the different counties :—

Bedfordshire	2	Kent	6
Berkshire	1	Leicestershire	1
Buckinghamshire	1	Lincolnshire	2
Cambridgeshire	5	London	3
Derbyshire	1	Norfolk	5
Devonshire	4	Nottinghamshire	2
Essex	7	Oxfordshire	2
Glamorgan	1	Shropshire	1
Gloucestershire	3	Suffolk	2
Hampshire	2	Surrey	3
Herefordshire	2	Sussex	1
Hertfordshire	2	Warwickshire	4
Huntingdonshire	1	Yorkshire	4

A list of the names and addresses of authorized millers and packers, which it is hoped to publish in the next (November) issue of the JOURNAL, can be obtained on application to the Ministry.

Authority to Use National Mark.—Full particulars of the Scheme, which came into force on October 1, were given in the September issue of this JOURNAL (p. 513). Some amendments have been made to the conditions of authorization, which are now as follows :—

(1) The National Mark may be applied only to packages containing flour made from wheat grown in England and Wales, unmixed with any other flour.

(2) The National Mark may be applied only by means of the official National Mark labels, which are obtainable, on payment, from the Ministry of Agriculture and Fisheries, and must be kept in safe custody, all precautions being taken by the authorized packers (including millers) to prevent their application by unauthorized persons. The labels are not transferable and may be applied only at the authorized premises as described below.

(3) National Mark labels may be applied only of the kind and in the manner approved by the Ministry of Agriculture and Fisheries as suitable for the size and type of package. Every package to which a National Mark label is applied must bear the name of the authorized miller or packer who applies the label.

(4) The quality of the contents of each package to which a National Mark label is applied (*i.e.*, National Mark flour) must conform to the statutory definition set out in Schedule I of the Agricultural Produce (Grading and Marking) (Wheat Flour) Regulations, 1929, according to the grade designation appearing on the label.

(5) Labels will be serially numbered at the time of issue, and an authorized packer must keep, to the satisfaction of the Ministry, a daily record of the serial numbers used.

(6) Where any authorized packer obtains all-English wheat flour and repacks it in containers bearing the National Mark, all the flour obtained and used for this purpose must likewise at the time of delivery to such packer be in containers to which the National Mark has been lawfully applied. Authorized packers who acquire all-English wheat flour for repacking under the National Mark must keep a record showing the receipts of flour under the National Mark, and the following particulars in regard to each consignment received, *viz.*, date, quantity, grade, serial numbers of labels.

(7) An authorized packer must notify the National Mark Committee, when, for any reason, his total weekly output of flour of all kinds packed and sold in the form of flour falls during any four consecutive weeks below the minimum weekly output, *i.e.*, 50 cwt. per week, which is required as a condition of his authorization.

(8) An authorized packer must allow his packing premises and all equipment and records to be inspected at any reasonable time by any officer of the Ministry of Agriculture and Fisheries authorized in that behalf and, if so required, must allow any such officer to be present when National Mark flour is being milled or packed, to take samples of wheat going forward to be milled, and to inspect at any reasonable time and place, and to draw samples from flour packed or intended to be packed by such authorized packer as National Mark flour.

(9) An authorized packer who is a miller of National Mark flour must keep, for a period of not less than one month, samples of the wheat actually used in each gristing of National Mark flour. An authorized packer who is a packer of all-English wheat flour must keep for a similar period, samples of the plain flours used in the preparation of each lot of National Mark flour (plain or self-raising).

The Minister and National Mark Flour.—Speaking at an opening luncheon at the Bakers' and Confectioners' Exhibition at the Royal Agricultural Hall on September 7, the Rt. Hon. Noel Buxton, M.P., Minister of Agriculture and Fisheries, said that he had always been particularly interested in all-English wheat flour, and for years had used it in his own household,

Referring to the competitions for all-English wheat flour which had been held for many years in connexion with the Bakers' Exhibition, he said that they had fulfilled a most useful function in showing that English wheat can yield good flour suitable for bread and confectionery of the finest quality. This had been demonstrated to the satisfaction of all good judges and bakers, and he hoped that the Press would assist in drawing the attention of the public to it. Referring to Yeoman wheat in particular—the product of Sir Rowland Biffen's patient research—Mr. Buxton said it afforded an outstanding example of the value to British agriculture of the scientific research work which was being conducted with the aid of the Ministry.

Mr. Buxton said that he realized, however, that before asking anyone to buy all-English goods it was essential to ensure that purchasers should get value for their money. The quality of the article must be guaranteed in some way. The Labour Government attached the greatest importance to the standardization and grading of agricultural produce as a means of helping the farmer to obtain his rightful share in the home market, and he was extremely glad that the first grading and marking regulations which he had issued after taking up office dealt with English wheat flour. After October 1 it would be possible both for bakers and for the general public to obtain National Mark All-English flour, guaranteed as to purity and quality by the same device—a silhouette map of England and Wales, with the words "Produce of England and Wales"—which had already been applied to eggs, apples, tomatoes, etc. Three grades were prescribed: (1) All-English Plain, (2) All-English Self-Raising, (3) All-English "Yeoman." The Scheme was already receiving excellent support from the millers, and all three types of flour would be available on the market in ample quantity as from October 1.

Apart from the advantages which it offered to bakers and consumers, the scheme was of great importance from the agricultural point of view, as a means of encouraging the growing of wheat, maintaining the arable area, and so contributing to the unemployment problem by retaining workers on the land. He appealed to bakers to use this great opportunity to interest the public in favour of the home-grown article, to farmers to do their part by ensuring sufficient supplies of the right kind of wheat, and to the general public to help the scheme by asking for the guaranteed article.

THE WEATHER AND AGRICULTURE IN THE BRITISH EMPIRE

A CONFERENCE between Empire meteorologists on the one hand and Empire agricultural scientists on the other, was held from August 28 to September 4, 1929, for the purpose of discussing agricultural meteorological questions. There have previously been Conferences of Empire Meteorologists for the pooling of meteorological knowledge, and there was, in 1927, an Imperial Agricultural Research Conference for the pooling of agricultural knowledge, but until the occasion now under mention there had been no gathering at which meteorologists had met agricultural workers of the Empire. Yet close co-operation between the two sets of workers is necessary for the solution of problems relating to the effect of weather on the soil, crops, animals, pests and diseases, and agricultural processes generally.

The arranging of the meeting was due to the Empire Marketing Board, who suggested that, with the approval of the various Departments concerned, the Conference of Empire Meteorologists arranged for August, 1929, should include an Agricultural Section. The British Agricultural Meteorological Committee was entrusted with the task of organizing this Section, and a grant of £500 to cover the expenses of organization was made by the Empire Marketing Board. The Agricultural Section of the Empire Meteorological Conference was attended by 35 overseas delegates and observers, of whom 21 were agriculturists and 14 were meteorologists and other officers. The home delegates to this section numbered in all some 80 workers in meteorology, agriculture and allied sciences. The chair at the meetings of the Section was taken by Sir Napier Shaw, F.R.S., and the secretariat of the Section, under the direction of Mr. W. R. Black, M.B.E., B.Sc., was provided by the Ministry of Agriculture and Fisheries. The subjects discussed by the Section were grouped under the following heads :—

Joint Sessions with Main Conference

General Climatology.

Seasonal Forecasting.

Agricultural Sessions

Historical Review of Subject.

A Weekly Calendar.

Weather and Crop Growth.

Measurement of Daylight.

Meteorological Research and Fruit Production.

Climate and Animal Distribution.

Weather and Insects.

Weather and Fungus Diseases of Plants.

Use of Meteorological Data in the Improvement of Crop Estimates.

The investigational papers presented were as follows :—

Agricultural Meteorology : A Brief Historical Review. *Sir Napier Shaw*.
Ten Points of a Weekly Calendar. *Sir Napier Shaw*.

Agricultural Meteorology in its Plant Physiological Relationships.
Professor V. H. Blackman.

The Varietal Response of the Plant to the Length of Day. *Mr. A. H. Tincker*.

Note on the Relation between Weather and Crops. *A. Walter*.
Climate, Soils and Crops in British Tropical Colonies. *F. J. Martin*.
Weather and Tobacco. *A. J. W. Hornby*.

Methods for the Photo-Electric and Photo-Chemical Measurement of
Daylight. *W. R. G. Atkins and H. H. Poole*.

Meteorological Research and Fruit Production. *H. V. Taylor*.

Meteorological Research and Fruit Production. *J. Turnbull*.

The Relation of Animal Numbers to Climate. *Charles Elton*.

Weather and Climate in their Relation to Insects. *B. P. Uvarov*.

The Relations of Entomology to Meteorology. *J. J. de Gryse*.

The Relation of Weather to Plant Diseases. *C. E. Foister*.

Crop Forecasting and the Use of Meteorological Data in its Improvement. *J. O. Irwin*.

Crop and Weather Data in India and their Statistical Treatment.
S. M. Jacob.

Weather and Wheat Yields at Lincoln College, New Zealand. *E. Kidson*.

The Ministry hopes to publish the proceedings of the Conference (Agricultural Section) in three volumes :—

- (1) The Report of the Conference (Agricultural Section).
- (2) The collected investigational papers, with discussions on these papers.
- (3) Surveys of the organization of agricultural meteorological work in various countries both within and without the Empire.

The Report will deal with the scope and methods of agricultural meteorological work and will contain the resolutions passed by the Conference on the subject of agricultural meteorology. These resolutions were as follows :—

The Week as a Unit.—In the opinion of the Conference the month is too long a period for the purpose of summarizing, for publication, statistics of agricultural meteorology, and the week should be adopted for that purpose.

Instruction in Meteorology and Agricultural Meteorology.—In view of the fact that technical information regarding weather has become a part of common life and the information is of little value to those who have no knowledge of the meaning and implication of the technical terms used, the Governments of the Empire should be invited to take into consideration the desirability of making suitable provision for instruction

in the physics of the atmosphere and the geography of weather in their national systems of education.

Instruction in the methods and results of agricultural meteorological research should form a more important part of the curriculum than is the case at present at University Departments of Agriculture, Agricultural Colleges, and Farm Schools.

Experimental and Demonstrational Work in Agriculture.—Experimental and demonstrational work, particularly that on cultivation operations, manuring and varieties of crops, should be accompanied by adequate meteorological observations, since such experimental and demonstrational work loses much of its value unless the results are discussed in the light of the meteorological conditions experienced during the course of the work.

Clearing Station for Information on Agricultural Meteorology.—The Conference considered the question of the establishment of a clearing station for information on methods and results of agricultural meteorological work. The following existing bureaux already, or will shortly, centralize information regarding the problems of the agricultural meteorological research worker, so far as their respective sciences are concerned, *viz.*, the Imperial Bureaux of Soil Science, Animal Nutrition, Animal Health, Animal Genetics, Entomology, Mycology, Plant Genetics (both general and herbage crops), Agricultural Parasitology and Fruit Production. The bulk of agricultural meteorological research work is probably covered by these Bureaux.

At the same time, it would be very convenient if all the information on the subject could be focussed at some one centre. Such centralization of information with subsequent distribution would be useful both to the agricultural meteorological research worker and also to the worker in pure meteorology.

With a view to obtaining experience which will prove useful as a guide to the Imperial Agricultural Research Conference of 1932 in considering the question, the Conference would be glad if the Ministry of Agriculture and Fisheries could develop the work it is already doing in this connexion, and could obtain from the existing bureaux, and from other sources, information on the methods and results of agricultural meteorological research, and could issue this information regularly to workers in agricultural science and pure meteorological science throughout the Empire.

This recommendation should not be taken as in any way prejudging the issue for the Imperial Agricultural Research Conference of 1932.

Fruit: Weather and Soil Surveys; Frost Damage and Varietal Susceptibility.—Surveys should be initiated or extended in the different parts of the Empire, to determine

- (i) the effect of varying weather conditions on the growth, cropping and resistance to diseases and pests of fruit grown on soils of various types, and
- (ii) the positions, under various conditions, in which it is inadvisable to plant fruit owing to risk of frost damage.

Further research should be carried out to determine the degree of susceptibility to frost damage of the chief commercial varieties of fruit and to discover the characters which confer resistance to frost.

Variations in Numbers of Wild Animals.—In the opinion of the Conference the economic importance of fluctuations in the numbers of wild animals, such as mice and rabbits, justifies the prosecution of research to ascertain the causes of these fluctuations, and in such research it appears essential that there shall be close co-operation between the meteorological and the biological research worker in order to ascertain how far these fluctuations are due to climatic causes.

Meteorological Observations of Local Climates.—The Conference is of opinion that the standard records of meteorological components form the base-line to which all investigations on agricultural meteorology must necessarily be related.

The local climate or weather in the immediate vicinity of the plant or insect in an agricultural crop or elsewhere may, however, be markedly different from that shown in the meteorological screen, and while the Conference recognizes that the records of such local meteorology must be made by the individual investigator for individual purposes, they, nevertheless, are of opinion that meteorologists could render valuable service to agriculture by assisting agriculturists to devise standard methods for adoption in the systematic recording of these local climates, and by studying the results as meteorological data.

Such recording requires appropriate instruments and screens for measuring the meteorological components among various crops in various horizontal strata, above and below ground, the latter in order to record the environment of the root system.

The standard records should be systematically extended, as opportunity offers, to measure, *e.g.* the intensity and quality of radiation and the moisture content of soil.

Insect Pests and Plant Diseases.—(a) *Forecasts, Spraying Advice, Description of Intensity of Attack.*—The Conference emphasizes the value to practical agriculturists of forecasts of seasonal appearance of insect pests and plant diseases and their mass outbreaks, and recommends that research directed to the discovery of the relations between the various meteorological factors and insect activities and plant diseases should be energetically pursued with a view to providing bases for such forecasts.

The Conference notes that entomologists and mycologists are investigating methods for determining and describing the intensity of attack of insect and fungus pests on crops, and expresses the hope that it will be possible for standard methods to be established.

(b) *Insect Investigations.*—Investigations should be carried out on the following subjects:—

- (i) The application of the climograph method to studies in the distribution, seasonal cycle of development and periodical fluctuations in the numbers of insects.
- (ii) The effect of atmospheric motion on the distribution of insects.
- (iii) The insect fauna of the upper atmosphere.
- (iv) The influence of coloration of insects on their thermal economy.
- (v) The effects of atmospheric pressure on insect activities and development.
- (vi) The part played by light in the development of insects.

The development of work along these several lines is dependent upon the co-operation of research meteorologists with entomologists, capable of dealing with the physiology of insects.

(c) *Plant Disease Investigations.*—An investigation should be carried out by plant pathologists in close co-operation with meteorologists to determine the distribution of fungus spores by the wind.

The Conference emphasizes the need for close co-operation between phenological mycologists and research workers engaged in investigations on the relation of weather to healthy crop growth and yield.

For the purpose of correlation of weather conditions with plant diseases, the Conference considers it to be very desirable

that continuous records from self-recording instruments should be available. It is particularly important that records should be taken of night temperatures.

Crop Forecasting.—The Conference has noted with satisfaction the progress that has been made in the use of statistics of weather in forecasting crop yields, and expresses the opinion that it is desirable that further investigations should be made into the possibility of improving forecasts of crop yields by this means.

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THE GRADING AND MARKING OF HOME-KILLED BEEF

In the opinion of many meat traders and beef producers, it is desirable that the response of the public to a grading and marking scheme for home-killed beef should be ascertained by the means provided by the Agricultural Produce (Grading and Marking) Act, 1928.

This Act enables the Minister of Agriculture and Fisheries (or, in the case of Scotland, the Department of Agriculture for Scotland) to make regulations prescribing grade designations for any kind of agricultural produce and defining the quality indicated by such designations. The Act provides that where any person sells an article of agricultural produce to which a grade designation is applied, then, notwithstanding any contract or notice to the contrary, it shall be deemed to be a term of the contract of sale that the quality of the article accords with the statutory definition of the grade designation. The Act also enables the Minister to make regulations prescribing marks to represent grade designations and to draw up conditions regulating the use of these marks; any person who sells, delivers or exposes for sale an article to which such a mark has been applied shall be regarded as using the grade designation thereby. No person may mark any article, covering, or label with a statutory grade designation mark, unless authorized to do so.

(1) An Experimental Scheme.—Under this Act, it is proposed to introduce, at an early date, an experimental scheme for grading and marking home-killed beef in certain urban areas under this Act. The areas chosen are, in the first instance, London and Birmingham, but carcasses destined for either the London or Birmingham market may be marked at Birkenhead. A similar scheme will be organized concurrently by the Department of Agriculture for Scotland at some Scottish centres

for supplies destined for Smithfield, London. The experiment will be carried on sufficiently long for the scheme to be tested effectively.

For the purpose of the English scheme, graders have been appointed for London, Birmingham and Birkenhead by the Ministry of Agriculture and Fisheries. These graders are authorized, if asked to do so, to grade and mark carcasses, sides or quarters, in the prescribed manner at certain killing centres in these areas, free of charge. The experimental scheme is thus voluntary and without cost to the distributor or producer.

The graders appointed are in all cases men who have held responsible positions in the meat trade and have a long practical experience of it. They alone will be authorized to grade and mark the carcasses in the manner prescribed.

(2) **The Grades.**—Grade designations and definitions as agreed to by the National Farmers' Union and national organizations representing the meat distributing trades are set out in the Appendix following, and are given statutory effect in the Agricultural Produce (Grading and Marking) (Beef) Regulations, 1929. Only home-killed beef of high quality will be graded and marked, and each carcass before being marked must have been inspected in the usual manner by the Health Authorities.

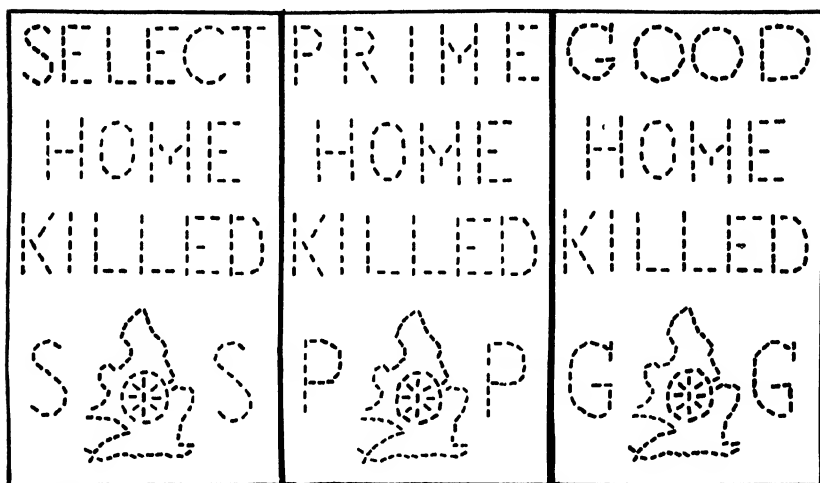
There are three grades, which are defined by regulation. The public are advised to study these grades, which signify different characteristics in the beef.

"**GOOD**" grade is the grade into which the greater part of the home-killed supplies of beef of good average quality naturally falls. Beef in this grade is mainly from bullocks and heifers, but the grade includes some first-class, young cow beef. On the whole, meat of this grade carries less fat than meat of the other grades. Many will, doubtless, prefer "Good" grade beef for this reason.

For those who want beef of superlative excellence, there are two super grades—"Select" and "Prime."

"**SELECT**" grade beef is from choice young animals. It is of exceptional tenderness, but the specially fed young animals are costly to produce and are in comparatively small supply.

"**PRIME**" grade beef has most of the good qualities of "Select" grade but it is from older animals. Hence, the joints are, in general, larger. Nevertheless, the finest steaks and stewing meat come from this class of animal, and the beef in all cuts is unsurpassed for flavour.



(3) **Method of Marking.**—The method of marking is by means of a roller stamp, drawn down the side of the carcass. The colouring matter is certified by the Government Chemist to be entirely non-injurious and the meat is not disfigured by the application of the mark. The mark carries the words “Good,” “Select,” or “Prime,” according to the grade, the words “Home Killed” and an outline map of England and Wales. On each side of the map there is a grade letter—“G,” “S,” or “P” (see illustration above).

The mark passes over most of the higher priced joints—the round, the rump, the sirloin and the ribs. Meat traders selling the graded meat are in the position of giving their customers a guarantee of origin and quality, vouched for by an independent judge, namely, the Government grader who has marked the carcass. Since a portion of the mark shows on the principal cuts, buyers of these cuts are assured that they are receiving what they have paid for—home-killed beef of high quality.

(4) **Conditions of Marking.**—Marking will be carried out at the public abattoirs and at certain other large abattoirs. It is not yet known how far it will be possible to extend the grading and marking service to private slaughter-houses in the areas concerned, but if a demand for this should arise, efforts will be made to meet it, so far as is practicable, at any rate in the case of the larger private slaughter-houses. Meanwhile, graded “National Mark” beef will be obtainable by any retailer at the wholesale meat markets in London and Birmingham.

Every trader, on the first occasion on which he asks to have

a carcass graded, must sign an undertaking to abide by the decision of the grader in regard to all carcasses that he has graded. Care will be taken to see that carcasses that are graded are from animals that have been properly rested before slaughter. The proper treatment of the meat after grading will be in the hands of the trade.

(5) Publicity.—The Ministry of Agriculture is arranging for publicity to be given to the scheme. Copies of this article in the form of a leaflet (Marketing Leaflet No. 13) and of Marketing Leaflet No. 13A, which is intended for meat traders to give to their customers, are obtainable from the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1. Posters and window bills drawing attention to the scheme are also available for meat traders desiring to stock graded "National Mark" beef.

(6) Future Developments.—Unofficial committees of distributors will be formed in London and in Birmingham to watch the technical arrangements and to make suggestions for any modifications that may be considered desirable in the light of experience. At the same time, the practicability of extending the beef grading and marking scheme to other consuming centres of England and Wales will be carefully considered by the Ministry of Agriculture and Fisheries in conjunction with the National Farmers' Union and other organizations concerned.

APPENDIX

Statutory Grade Designations and Definitions of Quality for Home-Killed Beef.

Grade Designation	Definition of Quality
SELECT	<p>A steer or maiden heifer beef carcass having excellent conformation, finish and quality, which are broadly indicated by the following characteristics.</p> <p>The carcass should be relatively short and stocky and heavily and uniformly fleshed. Rounds, loins and ribs should be extremely well developed and rounded. Chucks and plates should be unusually thick, compact and heavily fleshed. The neck should be very short and plump; shanks short and exceptionally well muscled. The superior muscular development of the round, extending well down towards the hock joint, should yield much beyond the average proportion of flesh in that cut. The spinal processes of the chine bones should terminate in fresh, pinkish white cartilages.</p> <p>The finish should be ideal, fat being neither excessive</p>

Grade Designation	Definition of Quality
SELECT—cont.	<p>nor deficient. The exterior surface of the carcass, including shanks and neck, should be entirely covered with smooth fat that is not excessively thick or wasty at any point, the greatest breadth—which should not exceed $\frac{3}{4}$-inch—being over the loins and ribs; the interior walls should be well-covered. Cod fat, or, in the case of a maiden heifer, udder fat, and kidney, aitch and other interior fats should be abundant but not excessive, also firm and ripe.</p> <p>The flesh should be firm, velvety, very finely grained and of a light rosy or cherry red colour and in the thicker cuts should possess an abundance of marbling.</p>
PRIME.	<p>A steer or maiden heifer beef carcass having good conformation, finish and quality, which are broadly indicated by the following characteristics and are, in all respects, somewhat above the average.</p> <p>Rounds should be reasonably thick and heavily muscled; loins and ribs should be moderately full and plump. Chucks and plates should be broad and moderately thick. The neck should be moderately short and thick.</p> <p>The fat covering should extend well over most of the exterior surface, and generally be firm and smooth, but may be somewhat patchy, especially over the rumps, loins, ribs and shoulders. The neck and lower part of the rounds, shoulders and shanks generally may have little fat covering. Cod fat, or, in the case of a maiden heifer, udder fat, and kidney, aitch and other interior fats may be either in moderate supply or somewhat excessive. Interior walls of the fore-quarters may be only partially covered. Usually the fat should be firm, brittle and reasonably white, but may have a slightly higher colour.</p> <p>The flesh generally should be moderately firm, the colour ranging from a light cherry red to a slightly darker red. The "eye" of the rib and loin should be above the average in thickness. Some marbling should be present in the thicker cuts.</p>
GOOD.	<p>A beef carcass having broadly the following characteristics. It may be slightly irregular or rough in conformation and quality, but it should be reasonably well finished. The frame may be slightly angular, the bones relatively prominent, the back slightly irregular, chucks and plates proportionately large, shanks and neck long, and rounds long and tapering. The fat covering should be fair, and there should be at least a small amount of cod (or udder) and kidney fats; other interior fats should be present. The flesh, however, should be of average thickness. In all, the carcass should be of average quality.</p> <p>Cow carcasses in this grade should have good conformation, except for a slight depression just in front</p>

Grade Designation	Definition of Quality
Good— <i>cont.</i>	of the rump. The loins and ribs should be relatively thick, and the rounds, while heavy, may be slightly lacking in depth. The shanks may be relatively long and tapering. With the exception of the neck and shin the carcass should be well covered with fat. There may be an inclination to patchiness on the loins and rump. The interior fats should be either in moderate or good supply, and should be of average quality. The aitch bone when cut through should show gristle.

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OCTOBER ON THE FARM

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Agricultural Organizer for Derbyshire.

Seasonal Notes.—In modern husbandry the seasons overlap and dovetail to such an extent that it is impossible to designate any point in the yearly cycle of agricultural events as marking the end of one farming year and the beginning of the next. At the end of September, even if all the hay and corn crops have been safely housed, the harvesting of the 1929 crops is incomplete, as the bulk of the potato crop, the sugar beet crop and the fodder roots are still in the fields ; moreover crops for next year's harvest have already been sown—the new “ seeds ” and perhaps wheat after bare-fallow. The impossibility of separating one year's work from that of another complicates the system of accounts necessary in farm book-keeping, as it occasions many estimates and assumptions concerning crops, etc., carried over.

By custom, tenancies of arable farms begin at this time of the year, and for several reasons October may be considered as the best starting point in the new round of arable land operations ; apart from the sowing of winter grain crops, the cultivations necessary for the success of next year's root crops must begin now if they are not already in full progress.

On the average of long periods, October ranks as one of the wet months, and not infrequently farmers have to wish for the arrival of the proverbial spell of twelve fine days, in order that they may proceed with potato lifting, mangold carting and wheat drilling. This year there are many who hope for copious rains to soften the stubbles for the entry of the plough,

to mellow the soil for wheat sowing, to freshen the pastures, to swell the roots and perhaps most of all to replenish the wells and springs. On looking through the rainfall records of previous dry summers, we find that in 1904 and 1911 October also was dry ; in 1913 and 1919 the rainfall in this month was about the normal ; and in 1906 and 1921 heavy rains fell in October after previous dry months.

Autumn Sowings.—Last winter proved a very severe test of the hardiness of the various kinds of winter grain. Until the end of January all kinds of corn maintained themselves satisfactorily, though at this period the effect of the water-logged condition of the soil had begun to tell on late sowings of wheat. Early-sown wheat, winter barley, rye and beans looked fairly well, but winter oats on other than dry soils had begun to lose plant and in some cases had been killed by frost. The severe low temperatures of February and March brought out the superior hardiness of early-sown wheat over all other grain except perhaps rye ; late wheat became thin and patchy ; winter barley fared badly ; beans suffered considerably, while of the winter oats only the grey sorts survived. These observations are in accordance with common experience in the northern half of the European continent : here the only safe winter crops are rye and wheat, both of which are sown in September or early in October—the rye first, as it tillers mainly in autumn. Under British conditions, however, it is often wetness rather than frost that has to be feared ; and on last year's observations both beans and barley can endure excess of moisture as well as wheat. There are, however, undoubtedly differences of economic importance in the winter hardiness of various wheats. Victor and Standard Red survived in Derbyshire last winter while other newer sorts sown alongside of these varieties were killed out either by wetness or by frost.

In ordinary seasons farmers often delay the sowing of wheat until near some local conventional date, such as October 21, for one or other of three reasons : bunt (" smut "), weeds, and winter proudness. Fear of bunt is now groundless, for by dressing the seed with powdered copper carbonate, crops can be ensured which are practically free from this disease ; moreover, this method of dressing is both safer and more convenient than the older wet processes. It is regrettable that so many farmers adhere to using the obsolete strong solutions of blue vitriol. Smut, however, sometimes called " blowaway smut," is not prevented by pickling or dry-dressing the seed, nor is it affected by date of sowing.

The standard quantity of seed wheat is $2\frac{1}{2}$ bushels per acre, more or less according to time of sowing and soil conditions. This allows for great loss of plant in winter but is sometimes insufficient for this purpose. As the Kirton experiments showed in the years 1924, 1925 and 1927, one bushel may give as good yields as heavier seeding ; but in ordinary practice the problem is to insure against being left with too thin a plant in spring. Some sorts, especially Rivetts, are customarily drilled too thin and, through inability to tiller out in spring, they are thin at harvest time.

Wheat comes up best on land that has been ploughed a month before drilling ; its ideal seed bed is "stale," firm and moist below, and with sufficient small clods on the surface to prevent capping and to afford shelter from wind and frost. The unsuitability of a loose spongy seed bed may sometimes be seen in the superior germination on the headlands, where there has been more treading. Rather than to sow early on a dry, open seed bed, it is better to delay drilling for two or three weeks to obtain better conditions of firmness and moisture. The heavy furrow press is a useful implement for sub-surface consolidation, but ordinary land rollers have an effect that is too superficial to be of much value in this connexion.

As regards depth of drilling, the customary cover of $1\frac{1}{2}$ to 2 in. is correct in October ; too shallow work may involve poor germination under dry conditions. Experiments have failed to indicate any advantage in surface sowing at this period and one has seen this method occasion failure where the land was dry. On the other hand deep drilling is undesirable in moist land and for November work.

Root Harvest.—The common aim in lifting mangolds is to complete the work before the commencement of injurious frosts, which may be expected about the first week in November. Leafy topped kinds, such as Red Intermediate, are better protected in this matter than the Yellow Globes ; and crops in close rows may be less injured by frost than those with wider spacings. Another consideration must be borne in mind, however : early lifting and carting may be a cause of bad keeping, especially in a dry autumn. According to certain investigations of Mansfield and Amos, reported upon in this JOURNAL in September, 1920, the roots keep best when carted under moist conditions. It is recommended, therefore, that if the soil is dry at the ordinary lifting time the roots after pulling should be left in small heaps in the field and carted home later, after there has been some rain. Why rain should improve

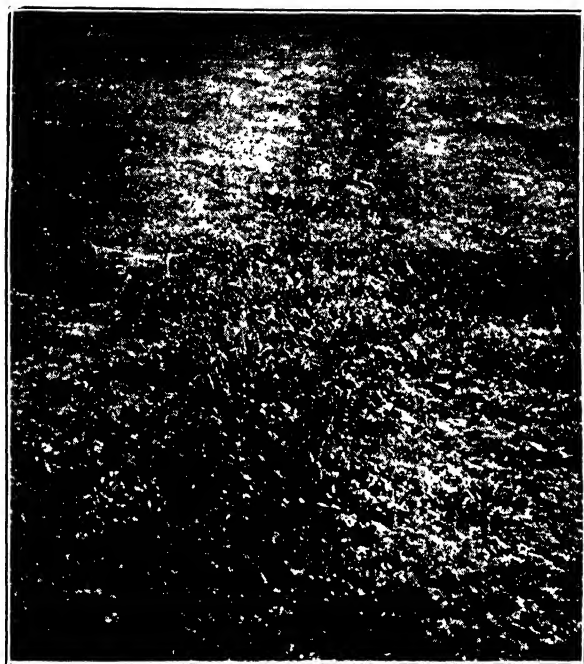
the keeping qualities of mangolds—it would have the opposite effect on potatoes—is obscure.

The feeding of mangold tops was discussed in these notes last year. All that need be added is an emphasis regarding the eminent desirability of keeping the leaves as clean as possible, to reduce the risk of intestinal disorders likely to be caused by feeding soiled leaves. In the beet-growing districts of Europe machines for washing the tops of mangolds and beet are used and regarded as essential to satisfactory feeding.

Beet tops may this year play a more important part than hitherto as feeding material. The common difficulty in making full use of this fodder is that of consuming it while fresh and clean. In both Denmark and Germany the period of feeding tops is extended by their preservation in silos. The possibility of ensiling beet leaves and crowns has been demonstrated in this country on a number of occasions, and the successful adoption of ensilage on a practical scale is described in respect of two farms on page 57 of the new Cambridge Report on "Sugar Beet in the Eastern Counties, 1928." One farmer ensiled about seven acres in a heap of the manure hill type, covered on the top with about one foot of soil. Another farmer ensiled six or seven acres in an earth pit measuring 15 yd. long by 3 ft. wide and 3 ft. deep—the Danish fashion. The middle was heaped up and the whole covered with soil like a mangold pit.

Lime and Matted Grass.—It is generally believed that a "mat" or "hide" does not form even on acid soil if the grass is kept closely cropped: mat formation has thus been attributed in the first place to insufficient grazing, followed by aggravation of the acid soil-conditions consequent upon the decay of vegetable matter on the surface. This is apparently an incorrect view, which tends to minimize the importance of lime in the matter of the maintenance of a good sward.

On one of the playing fields near the town of Derby may be seen a most striking example of the value of lime even where the herbage is kept closely cut and the clippings are regularly removed. The boundary lines and various area marks of a number of hockey and football pitches, and the former lines of a portion of the field where the tennis courts were at one time situated, now stand out prominently as bands of fresh, green clovery growth in striking contrast to the lifeless, brown and matted, though closely mown, turf on either side. The mark lines form continuous bands about a foot wide; there is no mat here, and the soil is moist to the surface instead



Touch line of Football pitch, showing stimulation of both grass and clover by marking with whiting.



North west corner of Hockey pitch. The dark lines represent the effect of whiting used in marking out the playing areas.

of being bone dry through the exclusion of rain. Earthworm castings are more numerous on the lines than off them.

The above effect is the simple result of repeated applications of calcium carbonate—whitening—in the marking out of the playing areas. The soil outside the lines has a definitely acid reaction; that on the lines, as might be expected, is alkaline. The acidity is due in part to the fact that the field is situated on the leeward side of the town and doubtless receives acid substances in the dew and rain.

Mineral Mixture.—A number of correspondents have written pointing out that the prescription given on page 474 of the August JOURNAL does not add up to 100·2 but to 95·2 only. It is regretted that by an oversight in transcription there was an omission of five parts of wood charcoal from the table of ingredients. Further experience of the use of the mixture in question indicates that while limited access may be necessary during the first few days, the cattle may soon be allowed to take the minerals without restriction.

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NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,

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Autumn Manuring.—The preparation of autumn seed beds brings in a fresh period of activity in the use of artificial fertilizers. If there is reason to believe that the crops will need phosphate, it is best applied at this stage. Should potash be required it may well be given in the seed bed, except where light soils are likely to be exposed to heavy rainfall. Nitrogenous fertilizers on the other hand are usually withheld until the spring, although it appears that in certain cases a part of the nitrogenous dressing may be given in autumn with advantage.

One of the effects of phosphatic manuring is to improve the crop in its earliest stages. In the past season this good effect of water-soluble phosphate on the development of the young plant was strikingly apparent on casual inspection of experiments, conducted from Rothamsted, on potatoes and sugar-beet. In cereals the result is an increased tiller formation and greater root range. The rate of action depends on the solubility of the phosphate used. Where phosphate is needed, the effect of superphosphate and of the high-soluble basic slags is rapid. Fortunately the latter are now more readily obtained than in the period immediately following the war. Bone manures,

unless "dissolved" or reduced to flour, and the ground rock phosphates take longer to act. The use of the latter is not usual for autumn-sown cereals, at any rate unless previous trial has indicated its value. The availability of ground rock phosphate depends on its fineness of grinding, and, for arable purposes in particular, every effort should be made to obtain the finest grade on the market.

A further effect of phosphate occurs late in the life of the plant when the crop approaches harvest, and consists in the well-known hastening of maturity which is so valuable on late soils and in wet districts. The actual quantity of phosphoric acid required per acre will depend upon the interval which has elapsed since last the field received phosphatic manure and upon the natural response of the soil to this fertilizer. In general, 35 lb. of phosphoric acid per acre is a common dressing, corresponding to about 2 cwt. of high-grade superphosphate or 3 cwt. of medium-grade basic slag. Since phosphatic fertilizers are now sold on their content of phosphoric acid the necessary amount of any grade is readily calculated.

Potash manures are often necessary for cereals on light, peaty and chalky soils, especially if it is some time since dung has been used. There are, however, certain heavier types of soil which respond to potash manuring. When required potash stiffens the straw and increases the vigour of the plant, while the quality of the grain is improved. From 30 to 50 lb. of potash per acre is the usual range of dressing for cereal crops, such a quantity being supplied by $\frac{1}{2}$ to 1 cwt. of muriate of potash or its equivalent in 30 or 20 per cent. potash salts. Where potash and phosphate are both required they may be applied together, and in such mixtures muriate of potash or 30 per cent. salts are rather more suitable than low-grade potash salts, on account of their better condition.

The provision of nitrogenous manures for autumn corn is unusual in England, although frequently practised on retentive soils in the drier parts of the Continent. It may be in place, however, when it is known that the land has been left poor in nitrogen and something is required to give the young corn a good start. It would be inadvisable, however, to give nitrogenous manures to late-sown wheat, since growth conditions are then at a minimum. In any case only a portion of the nitrogen would be given in this way, and either sulphate of ammonia or cyanamide would be chosen since they are less liable to loss through leaching than are nitrates. A suitable dressing would be 10 lb. of nitrogen per acre, or $\frac{1}{2}$ cwt. of either

of the fertilizers mentioned. If sulphate of ammonia is chosen it can be mixed if required with superphosphate and muriate of potash.

The leguminous crops beans and winter vetches are probably more responsive to phosphatic and, on light soils, to potassic manures than the cereals. It is not necessary, however, to give them nitrogen, although they greatly benefit from farmyard manure either direct or as a residue. These crops might receive phosphatic and potassic manures as for cereals, the higher rates of dressing being chosen.

The leys, especially those containing a good proportion of clovers, will also require attention at this time, provided that phosphatic manuring was not applied either to the cover crop or immediately after harvest. The good effect of a dressing of phosphate in improving the leguminous plants in a seeds mixture, and through them the subsequent crops in the rotation, has frequently been demonstrated. It is here that the use of the relatively cheap ground mineral phosphate has proved economical. In dry districts the more soluble phosphates are to be preferred, at any rate until the use of mineral phosphate has proved itself by trial. About 2 cwt. of superphosphate or basic slag or $1\frac{1}{2}$ cwt. rock phosphate might be given for each year the ley is to remain down, the last-named being more suited to longer leys than to one-year seeds. In the Eastern Counties potash has been found very valuable for promoting the growth of clover in leys in the lighter soils. If it has not been given to the previous corn crop it may still be applied as a top dressing. A usual amount would be about 50 lb. of potash per acre, *i.e.*, 1 cwt. of muriate of potash or its equivalent in potash salts.

Condition in Fertilizers.—It is not enough that an artificial manure should contain nitrogen, phosphoric acid and potash in an available form. It must also be in that state of fineness of division and dryness which enables the plant food to be lightly and evenly applied to the soil and readily mixed with it by subsequent cultivation. It is in this respect that compound fertilizers are frequently superior to home-made mixtures. In addition to chemical reactions between constituents of mixtures which may result in heating or caking, and in some cases in loss of plant food, the chief source of trouble is moistness or stickiness in the constituents themselves. Some of the fertilizer salts are deliquescent, *i.e.*, they take up moisture from damp air and become more or less liquid. The less this property is in evidence the more safely may a form of plant food be used

in mixtures. Determinations of the degree of deliquescence of some common manures put them in the following order: nitrate of lime, nitrate of ammonia, nitrate of soda, sulphate of ammonia, chloride of potash, sulphate of potash.

Nitrate of lime is not suitable for mixing purposes. Nitrate of ammonia would not mix well in its usual form, but treated by special technical processes it appears in dry granular form

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended September 11.				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	9 9d	9 9d	9 9d	9 9d	12 2
Nitro-chalk (N. 15½%) ..	9 19d	9 19d	9 19d	9 19d	12 10
Sulphate of ammonia:—					
Neutral (N. 20·6%) ..	9 9d	9 9d	9 9d	9 9d	9 2
Calcium cyanamide (N. 20·6%) ..	8 12e	8 12e	8 12e	8 12e	8 4
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%) ..	..	10 10h	..	..	..
Kainit (Pot. 14%) ..	3 6	2 19	2 19	2 18	4 2
Potash salts (Pot. 30%) ..	5 9	..	4 17	4 12	3 1
„ (Pot. 20%) ..	3 17	3 9	3 8	3 6	3 4
Muriate of potash (Pot. 50%) ..	9 17	9 3	9 2	8 16	3 6
Sulphate, „ (Pot. 48%) ..	11 19	11 6	11 5	10 11	4 4
Basic Slag (P.A. 15½%)|| ..	2 13c	2 3c	..	2 9c	3 1
„ (P.A. 14%)|| ..	2 7c	1 16c	1 16c	2 3c	3 2
„ (P.A. 11%)|| ..	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26·27½%) ..	2 10||	2 5||	..	2 5a	1 8
Superphosphate (S.P.A. 16%) ..	3 11	..	3 6	3 6	4 2
„ (S.P.A. 13½%) ..	3 5	2 15	3 0	3 0	4 4
Bone meal (N. 3½%, P.A. 20½%) ..	8 15	8 10	8 12	8 0	..
Steamed bone flour (N. ½%, P.A. 27½-29½%) ..	5 17b	..	6 10	5 5	..

Abbreviations: N.—Nitrogen; P.A.—Phosphoric Acid; S.P.A.—Soluble Phosphoric Acid; Pot.—Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 80% through standard sieve. a. 85% through standard sieve.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f F.o.r. Goolse.

in nitro-chalk. At the other end of the scale we have sulphate of potash which is one of the driest fertilizer salts, the chloride being a little more deliquescent. As is well known, the last three substances in the list may be used freely in home-made mixtures. Substances containing free lime, such as basic slag or cyanamide, are generally very dry but this does not mean that they can be stored in wet surroundings—the “setting” of basic slag on the farm is a well-known occurrence. To improve the condition of sticky mixtures a small proportion, about 10 per cent., of a “conditioner” is often used in the factory, and this practice can be copied with advantage on the farm. Suitable substances are steamed bone flour, rape or castor meal, and dried blood. They perform the double office of rendering the mineral mixture more friable and also bring in a certain amount of useful plant food. The analysis of the mixture may in certain cases be slightly lowered by the use of a conditioner, but this is not of practical importance.

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NOTES ON FEEDING STUFFS

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School of Agriculture, Cambridge.

The Feeding of Breeding Animals.—A happy mean must be sought in the feeding of breeding stock, for excessive or deficient nutrition may have a detrimental effect on their fertility. This should not be taken as meaning that the carrying of young by the female entails a large drain on the food supply of the body, for such is not the case, the foetus and its membranes being so largely composed of water. Once pregnancy has been established it is only in very rare conditions that feeding can influence the number of young born, but the state of nutrition before, and at the time of, service has a large effect on the chances of success, or on the size of the litter that is conceived. If the foetus made large demands on the food supply it would be expected that the yields of milking cows would suffer considerably when they were carrying a calf: there is certainly a falling off during pregnancy, but all the evidence goes to show that this is caused by a physiological process which occurs in the udder, preparing it for the next lactation, with a lowering effect on its activity during the current one.

Eckles in America has studied the question of the nutrients required to form a calf, and has found that, with Jerseys, the calf at birth is only equivalent to between 10 and 20 gallons of milk, in the food materials it contains. A very interesting point in his investigations was that he kept a cow on a maintenance ration (that is, one just sufficient to keep her weight constant when empty) all through a pregnancy, and obtained a normal calf and no loss in body weight. This appeared to indicate that the cow had made a calf out of nothing, and it could only be explained in two ways—either the cow was more efficient as a user of food whilst pregnant, or her maintenance was lower due to her leading a quieter life: as digestibility is not raised by pregnancy, Eckles inclined to the latter view. Similar results have been obtained with gilts, and it may be safely concluded that young gilts and heifers are not stunted in growth by early pregnancy, though they are very liable to be by the subsequent lactation. All our present knowledge of the question points to the conclusion that pregnant females require very little additional nutriment to form their young, over and above that which they should be receiving for maintenance and to support milk secretion or growth which may be going on: if, however, they are grossly underfed the pregnancy may be terminated prematurely, as has been known to happen with ewes.

The production of the little reproductive cells (eggs by the female and sperms by the male) may be influenced by the state of nutrition, and this is the way in which feeding does have a large effect on fertility, for either extreme in nutrition may produce temporary sterility. With under feeding, the eggs will not develop to full ripeness in the ovary, nor will the male produce vigorous sperms to fertilize them.

The effect of lack of nutriment on the fertility of females can be well seen with milking animals. A cow producing large quantities of milk is usually more difficult to get in calf early in the lactation than are lower yielders, because her output of milk requires all the nutriment she can digest, and there is none left over for the ripening of eggs. Similarly, it is usual for sows not to come on heat until after their litters have been weaned. A very clear case of this is seen with rabbits, where it is found that does suckling six or more young are temporarily sterile, that does suckling three, four or five young only produce small litters, whilst those suckling fewer than three will conceive and bring forth normal litters. Mr. Hammond has studied this question at great length, and his results show that the explana-

tion is nutritional—that is, when large litters are being suckled the drain for milk prevents egg production—but he has concluded that some special substance (or substances) may be the limiting factor, rather than the general nutritional condition: the two are, however, closely related.

In any diseased condition, such as generalized tuberculosis, which lowers the whole condition of the animal, the reproductive power is usually one of the first to be lost. Very recent researches have shown that there is a vitamin (E) which is necessary for fertility: if it is completely absent from the rations of rats for a long time they will become absolutely sterile. As far as our present knowledge goes, however, it appears that this fact has no practical importance, for it would be very difficult to find reasonable rations for farm stock which did not contain ample supplies of vitamin E.

It is probable that, taking the country as a whole, more harm is done to the fertility of breeding stock by over-feeding than by underfeeding. Over-fed females tend to have heat periods which are irregular and less marked than normal, whilst males may also lose their powers to a greater or lesser degree. In particular, as has often been pointed out, the system of judging which requires animals to be nearly fat when they enter the show ring, is all wrong for breeding animals. At spring stallion shows, many will be seen excessively fat, although this is rather a special case because they are just at the beginning of the service season, which entails a lot of hard work on the travelling stallion: for successful services, a harder condition would undoubtedly be better, but grooms find that if the stallions start the season in the proper state, they are usually very poor by June or July and their fertility drops on that account. The lowering effect of overfatness on fertility is actually brought about by deposition of fat on the ovaries and testes, which clogs their action: such a state can usually be rectified, if it has not gone too far, by feeding on a greatly reduced ration—to attain that condition of fitness rather than fatness, which is the ideal at which to aim. High feeding of young animals hastens sexual maturity, and so lessens the cost of raising breeding animals to their age of usefulness, for growth comes before reproduction in the animal economy, and consequently the more nutriment available the earlier will the stage be reached at which growth will leave a surplus, and the reproductive life begin. Animals are, of course, seldom used for breeding as soon as they are capable of it, since early lactation will prevent their full development—what is required is

to push their development forward so that the age may be reached earlier at which they can breed without stunting them.

Breeding animals should, therefore, be in moderate condition, neither fat nor poor, but the best condition of all is a rising state of nutrition. We have an excellent illustration of this in the "flushing" of ewe flocks, which is often carried out for a week or two before, and during, tupping time: this consists of a slight improvement in feeding, as by giving a small ration of cake or oats, or by folding on turnips, or even by merely putting them on to better pasture. It has been shown

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	9 2
Maize	81	6.8	9 12
Decorticated ground nut cake	73	41.0	12 0
„ cotton cake	71	34.0	10 15

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2.45 shillings, and per unit protein equivalent, 1.62 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1928, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	9 12
Oats	60	7.6	7 19
Barley	71	6.2	9 4
Potatoes	18	0.6	2 5
Swedes	7	0.7	0 18
Mangolds	7	0.4	0 18
Beans	66	20.0	9 14
Good meadow hay	37	4.6	4 18
Good oat straw	20	0.9	2 10
Good clover hay	38	7.0	5 4
Vetch and Oat silage	13	1.6	1 14
Barley straw	23	0.7	2 17
Wheat straw	13	0.1	1 12
Bean straw	23	1.7	2 19

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	—	—	10 15	0 12	10 3	72	2 10	1-52	9-6
Barley, British feeding ..	—	—	8 15	0 9	8 6	71	2 4	1-25	6-2
" Canadian No.4 Western ..	33 9	400	9 8*	0 9	8 19	71	2 6	1-34	6-2
" " feed ..	32 6	"	9 2*	0 9	8 13	71	2 5	1-29	6-2
" American ..	31 6	"	8 17	0 9	8 8	71	2 4	1-25	6-2
" Persian ..	32 6	"	9 2	0 9	8 13	71	2 5	1-29	6-2
Oats, English, white ..	—	—	8 0	0 10	7 10	60	2 6	1-34	7-6
" " black and grey ..	—	—	8 13	0 10	8 3	60	2 9	1-47	7-6
" Canadian mixed feed ..	20 3	320	7 2	0 10	6 12	60	2 2	1-16	7-6
" Argentine ..	24 9	"	8 13	0 10	8 3	60	2 9	1-47	7-6
" Chilean ..	24 6	"	8 12	0 10	8 2	60	2 8	1-43	7-6
Maize, American ..	43 3	480	10 2½	0 9	9 13	81	2 5	1-29	6-8
" Argentine ..	39 0	"	9 2	0 9	8 13	81	2 2	1-16	6-8
Peas, Japanese ..	—	—	17 15½	1 0	16 15	69	4 10	2-59	18
Dari ..	—	—	8 15†	0 11	8 4	74	2 3	1-20	7-2
Rye, Home-grown ..	—	—	9 10	0 12	8 18	72	2 6	1-34	9-1
Millers' offals—									
Bran, British ..	—	—	6 15	1 1	5 14	42	2 9	1-47	10
" broad ..	—	—	7 15	1 1	6 14	42	3 2	1-70	10
Middlings, fine, imported ..	—	—	8 5	0 15	7 10	69	2 2	1-16	12
" coarse, British ..	—	—	7 7	0 15	6 12	58	2 3	1-20	11
Pollards, imported ..	—	—	7 0	1 0	6 0	60	2 0	1-07	11
Meal, barley ..	—	—	10 0	0 9	9 11	71	2 8	1-43	6-2
" maize ..	—	—	10 15	0 9	10 6	81	2 7	1-38	6-8
" " South African ..	—	—	9 0	0 9	8 11	81	2 1	1-12	6-8
" " germ ..	—	—	9 10	0 14	8 16	81	2 2	1-16	10
" locust bean ..	—	—	9 5	0 7	8 18	71	2 6	1-34	3-6
" bean ..	—	—	13 0	1 3	11 17	66	3 7	1-92	20
" fish ..	—	—	19 0	3 3	15 17	53	6 0	3-21	48
Maize, cooked flaked ..	—	—	11 10	0 9	11 1	85	2 7	1-38	8-6
" gluten feed ..	—	—	9 15	0 18	8 17	76	2 4	1-25	19
Linseed cake, English, 12% oil ..	—	—	13 17	1 7	12 10	74	3 5	1-83	25
" " " 9% " ..	—	—	13 7	1 7	12 0	74	3 3	1-74	25
" " " 8% " ..	—	—	13 0	1 7	11 13	74	3 2	1-70	25
Soya bean ..	—	—	11 12	1 17	9 15	69	2 10	1-52	36
Cottonseed cake—									
English 4½% " ..	—	—	7 10	1 6	6 4	42	2 11	1-56	17
" Egyptian, 4½% " ..	—	—	7 7	1 6	6 1	42	2 11	1-56	17
Ground-nut cake, 6-7% oil ..	—	—	10 0†	1 5	8 15	57	3 1	1-65	27
Decorticated ground-nut cake, 6-7% oil ..	—	—	12 0†	1 18	10 2	73	2 9	1-47	41
Palm kernel cake, 4½-5½% " ..	—	—	9 15†	0 16	8 19	75	2 5	1-29	17
" " " meal, 4½% " ..	—	—	10 5†	0 16	9 9	75	2 6	1-34	17
" " " meal 1-2% oil ..	—	—	9 5†	0 17	8 8	71	2 4	1-25	17
Feeding treacle ..	—	—	6 7	0 8	5 19	51	2 4	1-25	2-7
Brewers' grains, dried ale ..	—	—	8 15	0 17	7 18	49	3 3	1-74	13
" " " porter ..	—	—	8 5	0 17	7 8	49	3 0	1-61	13
Malt culms ..	—	—	8 15§	1 5	7 10	43	3 6	1-87	16

* At Bristol.

† At Hull.

§ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of August and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.49d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 8s. 3d.; P₂O₅, 8s. 7d.; K₂O, 8s. 1d.

statistically that this practice has an appreciable effect in raising the number of lambs born per 100 ewes : it also tends to advance the tupping season slightly, but there is some evidence that ewes so treated one year must have the same treatment the next, otherwise their fertility will then be lower than if they had never been flushed. As soon as the rams are taken away, flushing is discontinued, because the number of lambs has then been determined, and they can be fed rather less, though, as mentioned above, their feeding must not be too low during pregnancy or abortion may be caused. Just before lambing, it is a good practice to raise the feeding again, with a little of such foods as oats, bran, and linseed cake, as this is found to have a good effect on their subsequent milk yield, which is reflected in the better growth of the lambs : thus ewes will pay for a small amount of "steaming up," which has been demonstrated to be desirable for cows.

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MISCELLANEOUS NOTES

It is certain that the extended tour of European countries which is being made by Mr. P. A. Francis, Director of the World Poultry Congress, accompanied by

World Poultry Congress, 1930

Mr. F. C. Elford, of Canada, Mr. W. A. Schleit, of the United States, and Mr. W. W. Baird, of Nova Scotia, will greatly strengthen European representation at the Congress. The chief purpose of the mission was to consolidate the support of European Governments for the important event which will take place at the Crystal Palace in July, 1930. The tour includes France, Portugal, Spain, Italy, Switzerland, Czecho-Slovakia, Austria, Hungary, the Serb-Croat-Slovene Kingdom, Roumania, Turkey, Greece, Palestine and Egypt.

The response to the British Government's invitation to the various countries of the world to participate in the Congress has been highly satisfactory. No fewer than 34 Governments have already decided to take part, including such far-off countries as South Africa, Nyasaland, Guatemala, Japan, Palestine, the Gold Coast, Lithuania, British Guiana, Nicaragua, Sierra Leone and Peru.

The representation of the European countries will be almost complete. Belgium, Czecho-Slovakia, Denmark, France,

Germany, Hungary, Italy, the Netherlands, Portugal, Spain, Sweden, Switzerland and the Serb-Croat-Slovene Kingdom are among the countries organizing strong National exhibits for the purposes of the Congress.

No effort is being spared to make the Congress the greatest event of its kind in the history of the world's poultry and small live stock industries. Every encouragement is being given to overseas participants to stage exhibits showing their leading national features and the development of their industries, and to enter displays of poultry, pigeons and rabbits in the livestock section. The method of staging the unique livestock display is receiving the earnest consideration of the Congress organizers.

The task of preparing the national exhibit for Great Britain and Northern Ireland is no light one. The exhibit will be shown side by side with other national exhibits, and it must compare favourably with the very fine displays which it is known are being prepared by many overseas countries. Fortunately, it has been possible to secure the valuable assistance of the Department of Overseas Trade, who are responsible for staging the attractive displays shown, for example, by the Empire Marketing Board. Mr. Claude Taylor, of the Department of Overseas Trade, has recently concluded an extended tour of Great Britain and Northern Ireland, for the purpose of assisting in the preparation of the scheme for the British national exhibit. It is desired to demonstrate the high standard of excellence reached by the home small livestock industries, and the part played by educational, research and voluntary organizations, in achieving that position. The marketing section will be treated separately, and the Departments of Agriculture for England and Wales, Scotland and Northern Ireland may be relied upon to deal adequately and effectively with the subject of the improved marketing of poultry and poultry products.

Every assistance is being given to the leading poultry and small livestock societies to enable them to bring their work to the notice of visitors to the Congress.

In the trade section there is still a certain amount of space unlet, and commercial interests are advised to send in their applications without delay. Most of this vacant space is in the Grade III site, and costs 2s. 6d. per square foot. Plans are maturing for making this part of the Crystal Palace specially attractive to visitors, and trade space at this low

price should prove profitable. The programme of entertainment during the Congress, including military displays and concerts, is certain to attract large numbers of visitors ; while a scheme is being arranged to ensure that everyone interested in poultry in this country is made aware of the Congress and is provided with every facility for attending it.

To those who desire to know how they can help to make the Congress a success it may be said that they should join the Congress as members ; see that every breeder of the highest quality poultry, rabbits or pigeons gets his entry form without delay ; bring the Congress to the notice of all commercial firms interested in poultry ; and above all, get all their poultry friends either to become members of the Congress or at least to make a point of visiting the exhibition.

Membership applications and livestock and trade entries are already sufficient to secure the unqualified success of the Congress, so that there is no fear of failure. This does not mean, however, that effort may be allowed to diminish : the sustained co-operation of the whole poultry and small livestock industry is still essential.

Mrs. Noel Buxton, wife of the Minister of Agriculture and Fisheries, will act as Chairman of the Ladies' Committee which is being set up in connexion with the Congress. This Committee will look after the special interests of lady delegates to the Congress and of ladies who may accompany delegates.

The final programme is not yet ready, but the preliminary announcement gives a broad indication of the scope of both Congress and Exhibition. Copies with the necessary forms of application for membership, etc., can be obtained from the Congress Secretary, Ministry of Agriculture, 10 Whitehall Place, London, S.W. 1.

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SHORT courses of instruction in clean milk production designed specially to afford assistance to Sanitary Inspectors in carrying out the duties assigned to them under the Milk and Dairies Order have been held throughout England and Wales during the past four years. Most of the courses have been held at provincial centres (Agricultural Colleges and University Departments of Agriculture), but in order to cater for Inspectors who were unable to obtain leave of absence to attend such courses, which were usually of about a week's

**Course in Clean
Milk Production
for Sanitary
Inspectors**

duration, it has been found convenient to decentralize them for Inspectors in particular counties. Decentralized courses, which are held at convenient centres in the counties concerned, consist of afternoon or evening sessions held one day per week over a period of four to five weeks.

The recognition of the value of these courses may be gauged from the fact that Sanitary Inspectors from 765 Local Authorities, out of a total of approximately 1,800, have attended, while in many other cases the Authority has been represented by the Medical Officer of Health.

* * * * *

THE index number for agricultural produce for August was 52 per cent. above the level of the base years 1911-13

as compared with 41 per cent. in the previous month and 44 per cent. in August, 1928. The rise of 11 points on the month was due partly to the higher prices realized for wheat and hay and to a slight rise in values for fat sheep but the main factors were the higher index numbers for milk and fat cattle.

In the following table are shown the percentage increases as compared with pre-war prices each month since January 1924 :—

			Percentage increase compared with the average of the corresponding month in 1911-13					
Month			1924	1925	1926	1927	1928	1929
January ..	..		60	71	58	49	45	45
February ..	..		61	69	53	45	43	44
March ..	..		57	66	49	43	45	43
April ..	..		53	59	52	43	51	46
May ..	..		57	57	50	42	54	44
June ..	..		56	53	48	41	53	40
July ..	..		53	49	48	42	45	41
August ..	..		57	54	49	42	44	52
September ..	..		61	55	55	43	44	—
October ..	..		66	53	48	40	39	—
November ..	..		66	54	48	37	41	—
December ..	..		65	54	46	38	40	—

Grain.—The average price of wheat in August at 11s. 8d. per cwt. was 1s. 4d. per cwt. higher than in July, and the index number rose by 18 points to 46 per cent. above pre-war. This rather exceptional advance is due to the fact that values were strongly influenced by the recent sharp rise in quotations for imported wheat. Values fell, however, in the latter part of August. The average price for barley was only 2d. per cwt. higher at 9s. 9d. per cwt., the quantity of new crop barley

marketed so far being rather smaller than in previous years. In the case of oats the average price declined by 4d. per cwt. to 9s. 1d., but the index number rose by 7 points to 30 per cent. above pre-war, owing to a proportionately larger fall in price in the corresponding period of the base years.

Live Stock.—Fat cattle were slightly cheaper than in July, but as the decline was proportionately less than that which occurred in July-August, 1911-13, the index number is 6 points higher on the month at 36 per cent. above the base period. Values for fat sheep and pigs rose a little during the month under review, the index number for the former showing an advance of 4 points, whereas the index numbers for fat pigs were lower on account of the fact that values in the corresponding period of 1911-13 showed a proportionately larger increase. A very dull trade for store cattle resulted in rather lower prices for this class of stock, the average being reduced about 15s. per head and the index-number is 6 points lower at 19 per cent. above the pre-war level, as compared with 29 per cent. in August last year. Dairy cows, store sheep and store pigs, however, were dearer on the month and in each case the relative index-numbers are higher.

Dairy and Poultry Produce.—The average contract price for milk was appreciably higher in August, owing to the arrangement approved by the Permanent Joint Milk Committee under which the August price for many districts was raised to the winter level. In the pre-war years 1911-13 contract prices remained at summer levels, and the comparison for index-number purposes caused a rise of 36 points in the milk index from 57 per cent. above pre-war in July to 93 per cent. in August, and this affected the general index-number for agricultural produce to the extent of over 6 points. Butter was 1d. per lb. dearer, while cheese was very slightly cheaper. There was a rise in egg prices of about 2½d. per dozen, but as this was nearly proportionate to the customary rise at this season of the year the index showed only a small increase of 2 points to 59 per cent. above pre-war. Poultry was cheaper, and the index-number declined by 10 points to 47 per cent. in excess of the base years.

Other Commodities.—New crop potatoes were about 25s. per ton cheaper than in July, but as the fall was proportionately a little less than in the period July-August, 1911-13, the index for the month under review was 6 points higher, although potatoes were only 2 per cent. dearer than pre-war, as compared with 35 per cent. in August, 1928, and 30 per

cent. in August, 1927. Both clover and meadow hay became appreciably dearer, the average increase being about 7s. 6d. per ton, and the index number at 41 per cent. above pre-war is 12 points higher on the month, and 28 points higher than a year ago. Apples sold at 28 per cent. and plums at 95 per cent. above pre-war prices, whereas vegetables were comparatively cheap, cabbages averaging 5 and cauliflowers 16 per cent. above pre-war.

Index numbers of different commodities during recent months and in August, 1927 and 1928, are shown below :—

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1927	1928	1929			
	Aug.	Aug.	May	June	July	Aug.
Wheat	56	30	25	21	28	46
Barley	64	58	34	33	30	31
Oats	43	49	31	26	23	30
Fat cattle	34	40	32	31	30	36
Fat sheep	45	59	57	59	55	59
Bacon pigs	36	36	81	70	64	60
Pork pigs	43	33	78	65	61	60
Dairy cows	25	33	32	30	33	35
Store cattle	26	29	23	22	25	19
Store sheep	48	55	51	65	60	64
Store pigs	70	26	81	77	80	85
Eggs	44	55	50	40	57	59
Poultry	43	45	65	63	57	47
Milk	55	55	57	57	57	93
Butter	38	54	50	46	52	48
Cheese	57	84	81	67	67	62
Potatoes	30	35	—3*	—34*	—4*	2
Hay	16	13	22	27	29	41
Wool	42	76	59	50	45	47

* Decrease

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LECTURES upon the Station Experiments are again to be given, during the coming winter, by members of the staff of the Rothamsted Experimental Station.

Rothamsted Winter Lectures, 1929-30 These lectures are designed for the benefit and information of Chambers of Agriculture and Horticulture, Farmers' Clubs, Farm Workers' Associations, Agricultural Societies, etc., and such organizations as desire to avail themselves of the facilities offered are invited to communicate with the Secretary, the

Rothamsted Experimental Station, Harpenden, Herts. Applicants are requested to comply with certain conditions regarding these lectures; in particular, they should indicate the subject or subjects which would be of most interest to them, and they should note that it is not practicable to deal with more than one subject in a single lecture. The Station will endeavour to meet their wishes in regard to the subject chosen and also their convenience in regard to dates. It is advisable, however, to offer the Station the choice of two or three alternative dates and to give as much notice beforehand as possible. No fee will be charged for the lecturers' services, but Associations engaging them are expected to defray their travelling and hotel expenses, and to make all necessary arrangements for the holding of the lectures. The following is a list of the lectures with the names of the respective lecturers:—

LECTURES BY MR. H. V. GARNER, M.A., B.Sc. (*Guide Demonstrator*)

- (1) Artificial Fertilizers and Their Use in Practice.
- (2) The Management of Farm Yard Manure.
- (3) The Manuring of Cereal Crops: the Results of some Modern Experiments.
- (4) Recent work on the Manuring of Potatoes and Sugar Beet.
- (5) Some Points in Manuring a Rotation of Crops.
- (6) Manuring as a Factor in Grassland Improvement.
- (7) The Rothamsted Field Experiments, 1843-1929.
- (8) Recent Additions to the List of Artificial Manures.

OTHER LECTURES

- (1) *Soil Micro-Organisms (Bacteria, Protozoa, etc.)*

(a) Lucerne Inoculation	Mr. H. G. Thornton, B.A.
(b) Life in the Soil	
(c) Biological Aspects of Partial Sterilization.	Mr. D. W. Cutler, M.A.
- (2) *Agricultural Botany*
Weeds of Arable and Grass Land Dr. Winifred F. Brenchley, F.L.S.
- (3) *Agricultural Chemistry*

(a) Liming and Chalking of Soils	
(b) Recent Developments in the Production and Use of Fertilizers	Dr. E. M. Crowther, F.I.C.
- (4) *Soil Physics*

(a) Is the Tractor an Economic Investment?	
(b) Can the Cost of Cultivation be Reduced?	Dr. B. A. Keen, F.Inst.P.
(c) The Art and Science of Cultivation.	
- (5) *Entomology*

(a) Insect Pests	Dr. A. D. Imms, M.A., F.R.S.
(b) Bee Keeping	Mr. D. M. T. Morland, M.A.

(6) *Mycology*

- | | | |
|--|---|---------------------------------|
| (a) Plant Diseases : Their Causes
and Control | } | Dr. W. B. Brierley, F.L.S. |
| (b) Soil Fungi and Plant Growth | | |
| (c) Fungus Diseases of Crops | | |
| (d) Virus Diseases of Plants | | Dr. J. Henderson Smith,
B.A. |
| (e) Plant Diseases : Their Causes
and Control | } | Mr. R. H. Stoughton, B.Sc. |
| (f) Bacterial Diseases of Crops | | |

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At the instance of the Scottish National Farmers' Union, over 2,750 tons of potatoes have been sliced and dried at the Cupar Beet Factory belonging to the Anglo-Scottish Sugar Beet Corporation. The experiment took place late in the season when the potatoes were not in very good condition, owing to the prolonged storage period, and on that account the experiment was not quite so successful as it would otherwise have been.

Over 200 tons have also been successfully treated at the Eynsham factory belonging to Messrs. Sugar Beet and Crop Driers, Ltd.

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The Ministry has just issued a register of the names and addresses of growers of strawberry plants whose fields have been examined during the past growing season, and whose stocks have been certified by the Ministry's Inspectors to be typical of the variety and reasonably free from rogues.

Growers who intend to purchase runners for planting would do well to consult this register before placing their orders. Copies can be obtained free of charge on application to the Ministry's Offices, 10 Whitehall Place, London, S.W. 1.

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A MARKETING demonstration covering bacon and poultry and a display of National Mark eggs will be staged at the London Dairy Show at the Agricultural Hall from October 22-25.

Marketing Demonstrations at Agricultural Shows At the Imperial Fruit Show, which opens at Birmingham on October 25, a demonstration will be given of the grading and packing of apples to National Mark standards on a commercial scale.

THE latest returns received from the Ministry of Health indicate that the numbers of licences for the production of graded milk issued and in force in England up to March 31, 1929, were as follows: Certified 144, Grade A (T.T.) bottling 40, Grade A (T.T.) non-bottling 144, Grade A 436. These numbers show a slight increase on the licences in force at the end of the previous half year. The corresponding figures for Wales, which have been received for the first time, were 6, 13, 20, and 26 respectively.

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THE Ministry is informed that, as a further result of the Conference called at Washington, in June, 1928, by the Federal Horticultural Board of the United States Department of Agriculture, to consider the advisability of placing further restrictions on the importation of fruit and rose stocks (see this JOURNAL, October, 1928, p. 679) it has been decided that Mahaleb cherry, Myrobalan plum and other fruit stocks such as fig, nut, persimmon, &c., which have been imported hitherto in relatively small numbers, will be excluded from entry into the United States on and after July 1, 1931.

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THE number of candidates who applied this year for scholarships was 470, and 122 were successful in gaining awards. The scholarships, which range from four-year courses at Universities to short courses at Farm Institutes, provide for payment of the entire cost of instruction and maintenance.

Scholarships for the Sons and Daughters of Agricultural Workmen and Others Since 1922, when the scheme started, 963 scholarships have been awarded, the distribution among the various classes

of beneficiary being as follows:—

Sons and daughters of agricultural workmen	..	..	..	253
„ „ „ „ working bailiffs	..	..	..	60
„ „ „ „ smallholders	..	..	..	251
„ „ „ „ other rural workers (e.g., blacksmith, wheelwright, saddler, etc.)	..	..	..	159
Candidates who qualified on their own account as <i>bona fide</i> workers in agriculture	..	..	..	240

963

FIELD DRAINAGE SCHEMES FOR THE ALLEVIATION OF UNEMPLOYMENT AND THE IMPROVEMENT OF AGRICULTURAL LAND

(1) The Minister of Agriculture and Fisheries is prepared to make grants to owners of agricultural land in aid of the cost of approved works of field drainage. The scheme is designed for the relief of unemployment as well as for the benefit of agriculture.

(2) In the case of any approved works, the Minister will be prepared to contribute up to a maximum of £6 per acre or 33½ per cent. of the actual net cost of the work, whichever is the less, such actual net cost to be ascertained to the Minister's satisfaction. The grant may, however, be increased to a maximum of 50 per cent. of the actual net cost without any overriding amount per acre, provided that :—

(a) not less than 50 per cent. of the labour to be engaged upon the work is obtained through the Employment Exchanges from certain depressed areas selected by the Ministry of Labour (i.e., "transferred" labour); and

(b) the area in which the work is proposed to be carried out is one *not* suffering from severe and prolonged unemployment and is therefore suitable for absorption of "transferred" labour. Information on this point may be obtained from the nearest Employment Exchange.

(3) The wages of ordinary farm or estate staff will not be eligible to rank for the purpose of the grant.

(4) *It will be a condition of every approved scheme that all unemployed labour should be obtained through an Employment Exchange.*

(5) It must not, however, be assumed that every scheme will be regarded as eligible for the maximum grant. Each proposal will be considered on its own merits, subject to the above limitations.

(6) A landowner carrying out approved works will do so on his sole responsibility, and must undertake to abide by the conditions on which the scheme is approved. He must undertake not to place orders for plant and material with other than British firms except with the prior written approval of the Ministry. He must pay the employees at proper rates, being in no case less than the rates paid to unskilled agricultural labourers as fixed by the Agricultural Wages Board for the district. He must also insure all employees, since in no case will compensation paid in consequence of neglect of this precaution be admitted as part of the cost of the works for the purposes of grant.

(7) If an owner proposes to employ "transferred" labour (*see* paragraph 2) he will be required to satisfy the Committee that suitable accommodation already exists or will be provided for the men to be transferred. He will also be required to submit to the Ministry of Labour, periodically, when requested, a return respecting transferred labour engaged upon approved works.

(8) The scheme will be administered on behalf of the Minister by the Agricultural Committee for the County (or County Borough having an Agricultural Committee) in which the land is situated. Any owner desiring to avail himself of the facilities offered by the scheme should make an application to the Agricultural Committee in a form which will be supplied by them. The Committee will investigate the application and if they are satisfied that the land will benefit from the work proposed to be carried out, that the method of drainage proposed is the most suitable and economical in the circumstances, and that the estimated net cost is reasonable, they will forward the application to the Ministry, together with their recommendation as to grant.

Approval of any proposals by the Ministry will be notified to the applicant by the Committee and the work can then be commenced.

(9) The date of commencement as well as the date of completion of any approved works must be notified immediately to the Agricultural Committee. Monthly returns of the men employed on approved works must be supplied on request to the Committee. On completion of the work the Committee will require to be supplied with a statement of account (supported by receipted vouchers) in connexion therewith. The Committee will also make any necessary inquiries to enable them to certify to the Ministry that the works have been carried out to their satisfaction and in accordance with the approved proposals and that all the prescribed conditions have been fulfilled. The Ministry will reserve the right to make independent inquiry on these points if considered necessary.

(10) Committees are authorized to make a reasonable overhead charge for their expenses in dealing with applications; such charge will be treated as part of the net cost of the works and will rank for grant. Grants will be paid by the Ministry through the appropriate Committee, by whom payment will be made to the landowner after deducting the amount chargeable for the Committee's expenses.

(11) All inquiries on the subject of grants under this scheme should be addressed to the appropriate Agricultural Committee and not to the Ministry.

WATER SUPPLY SCHEMES FOR THE ALLEVIATION OF UNEMPLOYMENT AND THE IMPROVEMENT OF CONDITIONS IN RURAL AREAS

(1) The Minister of Agriculture and Fisheries is prepared to make grants to owners of agricultural land in aid of the cost of approved works of water supply to groups of holdings. The scheme is designed for the relief of unemployment as well as for the benefit of agriculture.

(2) In the case of any approved works, the Minister will be prepared to contribute up to a maximum of 33½ per cent. of the actual net cost of the work, as ascertained to the Minister's satisfaction. The grant may, however, be increased to a maximum of 50 per cent. of the actual net cost provided that:—

- (a) not less than 50 per cent. of the labour to be engaged upon the work is obtained through the Employment Exchanges from certain depressed areas selected by the Ministry of Labour (i.e., "transferred" labour); and
 - (b) the area in which the work is proposed to be carried out is one not suffering from severe and prolonged unemployment and is therefore suitable for absorption of "transferred" labour. Information on this point may be obtained from the nearest Employment Exchange.
- (3) The wages of ordinary farm or estate staff will not be eligible to rank for the purpose of the grant.

(4) *It will be a condition of every approved scheme that all unemployed labour should be obtained through an Employment Exchange.*

(5) It must not, however, be assumed that every scheme will be regarded as eligible for the maximum grant. Each proposal will be considered on its own merits subject to the above limitations.

(6) No scheme for the supply of water to villages or for other purposes will be considered unless the main purpose of the scheme is

agricultural. At the same time it should be clearly understood that the only schemes eligible for these grants are those submitted for the supply of water to groups of holdings, or schemes which include the supply of water to one or more cottages as well as to fields or farm buildings. Schemes promoted by local authorities and involving any payment out of local rates cannot be considered.

(7) Landowners carrying out approved works will do so on their own responsibility, and must undertake to abide by the conditions on which the scheme is approved. They must undertake not to place orders for plant and material with other than British firms except with the prior written approval of the Ministry. They must pay the employees at proper rates, being in no case less than the rates paid to unskilled agricultural labourers as fixed by the Agricultural Wages Board for the district. They must also insure all employees, since in no case will compensation paid in consequence of neglect of this precaution be admitted as part of the cost of the works for the purposes of grant.

(8) If an owner proposes to employ "transferred" labour (*see* paragraph 2) he will be required to satisfy the Committee that suitable accommodation already exists or will be provided for the men to be transferred. He will also be required to submit to the Ministry of Labour, periodically, when requested, a return respecting transferred labour engaged upon approved works.

(9) The scheme will be administered on behalf of the Minister by the Agricultural Committee for the County (or County Borough having an Agricultural Committee) in which the land is situated. Landowners desiring to avail themselves of the facilities offered by the scheme should make application to the Agricultural Committee in a form which will be supplied by them. The Committee will investigate the application and if they are satisfied that the scheme conforms to the conditions and will be beneficial and that the estimated net cost is reasonable, they will forward the application to the Ministry together with their recommendation as to grant. Approval of any proposals by the Ministry will be notified to the applicant by the Committee and the work can then be commenced.

(10) The date of commencement as well as the date of completion of any approved works must be notified immediately to the Agricultural Committee. Monthly returns of the men employed on approved works must be supplied on request to the Committee. On completion of the work the Committee will require to be supplied with a statement of account (supported by receipted vouchers) in connexion therewith. The Committee will also make any necessary inquiries to enable them to certify to the Ministry that the works have been carried out to their satisfaction and in accordance with the approved proposals and that all the prescribed conditions have been fulfilled. The Ministry will reserve the right to make independent inquiry on these points if considered necessary.

(11) Committees are authorized to make a reasonable overhead charge for their expenses in dealing with applications; such charge will be treated as part of the net cost of the works and will rank for grant. Grants will be paid by the Ministry through the appropriate Committee, by whom payment will be made to the landowner after deducting the amount chargeable for the Committee's expenses.

(12) All inquiries on the subject of grants under this scheme should be addressed to the appropriate Agricultural Committee and not to the Ministry.

Post Graduate Agricultural Scholarships.—On the recommendation of the Advisory Committee on Agricultural Science, post-graduate agricultural training scholarships have been awarded to the following :—

<i>Name</i>		<i>Subject</i>
W. H. Jones	.. ..	Agricultural Economics
J. Edwards	.. ..	Improvement of Live Stock
H. Hirst	Animal Husbandry
T. E. Jones-Davies	Veterinary Science
F. Darling	Animal Breeding

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Research Scholarships.—On the recommendation of the Advisory Committee on Agricultural Science, research scholarships have been awarded to the following :—

<i>Name</i>	<i>Subject</i>
H. R. Catchpole	.. .. Animal Nutrition
T. W. Clouston	.. .. Plant Pathology
S. Clay	.. .. Plant Breeding
G. L. Hey	.. .. Entomology
Miss M. I. Christian	.. .. Dairy Bacteriology (for one year only)
E. Lorrain-Smith	.. .. Economics

The agricultural scholarships are usually tenable for two, and the research scholarships for three, years. The second year, or third year, as the case may be, is usually spent abroad. The value of each scholarship is £200 in the first year; extra travelling and subsistence expenses may be paid in the year which is spent abroad. Scholars' fees are also paid.

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Special Research Grants.—The following awards of special research grants for 1929-30 have been made on the recommendation of the Advisory Committee on Agricultural Science :—

<i>Institution</i>	<i>Investigation</i>	<i>Amount</i> S.=Salary E.=Expenses	<i>Investigator</i>
I. RENEWALS			
		£	
University College of North Wales, Bangor	Kemp in the fleece of Welsh Mountain sheep	E. 175	R. G. White and J. A. Fraser Roberts
School of Agriculture, Cambridge do.	Good and bad fields of wheat	S. 300	G. A. Stevenson
	Grassland investigations (to include both English and Scottish work)	E. 30 E. 400	Grassland Subcommittee
East Malling Research Station	Apple scab and mildew	S. 220 E. 20	Mr. M. H. Moore
Liverpool University	Pregnancy disease in ewes	E. 200	Professor S. H. Gaiger and K. D. Downham
Rothamsted Experimental Station	Examination of data collected under the Ministry's Meteorological scheme	S. 300 E. 100	J. O. Irwin

<i>Institution</i>	<i>Investigation</i>	<i>Amount</i> <i>S.=Salary</i> <i>E.=Expenses</i>	<i>Investigator</i>
I. RENEWALS—cont.			
South Eastern Agricultural Col- lege, Wye do.	Virus disease of hops	S. 100	Professor E. S. Salmon and assistant
	Capsid Bugs	S. 200 E. 15	Mr. Austin
Oxford University	Breeding of Oats for resistance to frit fly attack	S. 150 E. 190	N. Cunliffe with technical assist- ance
II. NEW APPLICATIONS			
Bristol University	Use of dust sprays for control of plant dis- eases and pests	S. 50 E. 10	J. H. Lees
Department of Animal Patho- logy, Cambridge University	Use of B.C.G. Vaccine in the protection of calves against tuber- culosis	E. 375	Professor J. B. Buxton and A. S. Griffith

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APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Durham : Miss R. Townend, N.D.D., has been appointed Assistant Dairy Instructress.

Hampshire : Mr. T. W. Williamson, B.Sc., N.D.D., has been appointed Assistant Agricultural Organizer.

Kent : Mr. T. W. McDougall Porter, M.C., N.D.A., formerly Assistant Agriculturist, has been appointed Principal of the Borden Farm Institute, near Sittingbourne, which opens this month.

Mr. R. Hart, N.D.A., N.D.D., has been appointed Instructor in Commercial Horticulture.

Mr. E. A. Bartlett, N.D.A., has been appointed Lecturer in Agriculture.

Middlesex : Miss M. Mason, B.Sc., has been appointed Assistant Horticultural Instructress.

Staffordshire : Mr. H. G. Halford, has been appointed Assistant Instructor in Poultry Keeping, *vice* Mr. T. B. Woodcock.

Yorkshire : (Agricultural Department, University of Leeds.) Mr. F. Hawkins has been appointed Instructor in Horticulture, *vice* Mr. G. H. Nash, N.D.H.

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND AND WALES.

School of Agriculture, University of Cambridge.

The following staff changes took effect on October 1 :—

University Lecturer in Agriculture and Director of the University Farm :
Mr. W. S. Mansfield, M.A., *vice* Mr. Arthur Amos, M.A.

University Lecturer in Animal Husbandry : Mr. F. H. Garner, M.A., *vice*
Mr. W. S. Mansfield, M.A.

Mr. H. G. Sanders, M.A., Ph.D., is appointed a *Faculty Lecturer in Crop Husbandry*.

Foot-and-Mouth Disease.—After an interval of 3 months' complete freedom from foot-and-mouth disease in Great Britain, the existence of disease was confirmed on September 7 at Bishopbriggs, Cadder, Lanarkshire, and the usual order was made prohibiting the movement of animals in an area of approximately 15 miles radius round the infected premises.

Further cases have been confirmed at Kirkintilloch, Dumbarton, on September 12 and September 19, and at Bishopbriggs, Lanarkshire, on September 13. Both these cases are in the same neighbourhood as the original case.

There have been 27 outbreaks since January 1 last, involving 11 counties and the slaughter of 734 cattle, 994 sheep, 969 pigs, and 4 goats.

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Enforcement of Minimum Rates of Wages.—During the month ending September 15, legal proceedings were instituted against six employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages	No. of workers in- volved
		£	s.	d.	£	s.	d.	£ s. d.	
Derby ..	Derby ..	2	0	0	1	0	0	25 0 0	2
" ..	" ..				Case dismissed				1
" ..	Chesterfield ..	—			1	6	0	20 0 0	2
Hereford ..	Ross ..	—			10	10	0	21 8 0	4
" ..	Weobley ..	0	5	0	4	8	0	5 10 0	1
Somerset ..	Shepton Mallet	2	0	0	5	5	0	10 4 0	1
		£4	5	0	£22	9	0	£82 2 0	11

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NOTICES OF BOOKS

Experimental and Research Station, Cheshunt : 14th Annual Report, 1928. Pp. 126. (Cheshunt Press, Ltd.)

Virgin soil is always prized for tomato production, and very heavy crop yields are usually taken from it. Under continuous tomato culture the size of the crop falls, often in a surprising manner, and though artificial manuring may retain the production at a lower level, it does not seem able to restore to the soil its former virgin fertility. This is not only a very interesting research problem but is of such practical importance that it is pleasing to see that it has been dealt with in this Report.

The experiments were commenced in 1923, in four new tomato houses, three of which (7, 8 and 9) were manured in the usual way and produced crops of 55·8 tons, 55·2 tons and 51 tons per acre respectively. In 1928, the plots under the same standard treatment yielded reduced crops of approximately 38, 33 and 46 tons per acre respectively. So far the best treatment to maintain the high initial yield has been the digging of freshly cut grass into the soil during December and January. The application of wheat straw in 1926 also gave good results. This suggests that the increase in yield is caused

by green residue and fibre and its reaction on bacterial activity and aeration. A story simple yet important.

The report deals also with experiments on the best way of watering tomatoes. Should the water be broadcast over the surface soil, poured into pipe drains running through the soil, or into earthenware pots resting in the soil, or should the plants be irrigated with water running in trenches? Provided the supply proved adequate it might have been thought that it would have made no difference. The results at the Station, however, are in favour of planting in trenches six inches deep. The trench remained moist continuously and seemed by conserving the little water applied each day when damping overhead, to hold sufficient.

The report contains the results of many other experiments dealing with the everyday practices of glasshouse production. In the chapters dealing with mycological and entomological investigations it is pleasing to note that considerable success in controlling red spider in tomato and cucumber houses by using petroleum emulsions (directions for the preparation of which are given in the Report) is recorded. Red spiders, which cause much damage, have been very difficult pests, and this fresh method of control will be much welcomed.

This little book of 126 pages is full of matter of practical interest, and should be read by all growers of glasshouse crops.

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Sugar Beet in the Eastern Counties (No. 2), 1928.—By C. Burgess, B.A. (Dip. Agric. Econ.) with some observations by G. Ll. Rogers, M.A. (Dip. Agric. Econ.) Univ. of Cambridge, Dept. of Agric., Farm Economies Branch Report No. 13. (Cambridge: W. Heffer & Sons, Ltd., 1929. Price 2s. 6d. net.)

This report succeeds No. 9 of the series, which was noticed in this JOURNAL for March last, and deals with the costings of a slightly smaller number of fields (173 as against 182) or one hundred farms in East Anglia. The farms are not all the same as those previously costed, 43 of the total number being new, but the report states that the change in sample has not affected the representative nature of the farms and does not, therefore, vitiate comparison between the two years' results.

This is more satisfactory in view of the better profits obtained from the crop in 1928. The cash profits increased from 5s. 5½d. in 1927, to £2 16s. 4d. per acre in 1928. The net profits also rose from £4 4s. 1d. in 1927 to £6 19s. 9d. in 1928. As the report says, "Such a result suggests that, in 1928, sugar beet growing was not unsuccessful from a cash point of view, and, when full advantage could be taken of the by-products and consideration given to residual values, the net result was very satisfactory."

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British Farm Crops.—By A. W. Oldershaw and John Porter. *Farmer and Stockbreeder* series. Pp. 306. (London: Ernest Benn, Ltd. 1929. Price 12s. 6d. net.)

This volume is of a kind that should appeal to the agricultural student and the farmer. It is written in simple non-technical language and is essentially science as applicable to the farm. The information and advice it contains are based largely on the authors' own work, and on that of collaborators in the same field. The book contains—what so many text-books lack—descriptions of the methods of successful farmers. These methods may be unorthodox, but, being the result of the observations and experience of practical men, they are invariably interesting and suggestive.

East Malling Research Station : Annual Report, 1928. (Published at the Research Station, East Malling, Kent. Price 3s., post free 3s. 6d.)

This is probably the best and fullest report that has been issued by the Station. In recent years the East Malling Station has expanded very considerably, and now occupies a prominent position among the Research Stations of this country. Its situation amidst the Kentish fruit plantations is admirable for enabling it to pursue research into fruit problems, but it also carries with it the task of advising growers on the many difficulties with which they are confronted. In 1928, for instance, no fewer than 1,708 visitors in search of knowledge visited the Station, and were shown round the many experiments, whilst 1,218 queries—the majority of a pomological character—were addressed to, and dealt with, by the Station. This work is, of course, additional to its main research work, but it helps to make the latter better known and appreciated by the industry.

This report contains an excellent paper by R. G. Hatton on "The Effect of Various Fruit Growing Practices on Fruit Quality and Market Value," in which the author deals with the way in which winter pruning, spraying, manuring and thinning, and, finally, the use of special root stocks, enable the market grower to improve the quality of his crop. In fact, quality fruit is the result of these practices judiciously and rightly applied. In an appendix are given details of the spraying costs at East Malling for one tar-distillate wash, two lime-sulphur washes at blossoming, followed by a colloidal sulphur wash; these four sprays applied to 640 bush apples, 14-15 years old, cost in labour and material a sum of over £19 per acre.

	<i>Per tree</i>	<i>Per acre</i>
		£ s. d.
The tar-distillate spray	7.89d.	7 6 0
Pre-blossom lime-sulphur	4.48d.	4 2 9
Post-blossom lime-sulphur	5.44d.	5 0 7
Sec. ditto colloidal sulphur	2.75d.	2 10 10
Total	20.56d.	£19 0 2

Costs are also given for the manures used. The figures show in a striking way that modern fruit growing is an expensive business.

H. H. Grubb outlines the deductions that can be drawn from the East Malling Experiments on apple pruning, and emphatically shows that pruning for form and artistry should no longer be done. Pruning must be adapted to the root stock and soil, and varied with each variety. Leader tipping, which is advocated for the permanent trees, lessens the fruit crops up to the ninth year, and in consequence should be very lightly done on filler trees. Long continued leader tipping even of permanent trees before the trees come fully into cropping often produces crowded wood growth, particularly with Allington.

Progress reports of the work done in physiology, biochemistry and plant pathology are also given, together with summaries of the work done in each subject and any published paper on the work. In the entomological section, H. M. Massee contributes a paper on "The Fruit Tree Red Spider"; the advice is timely, for, as Massee says, this pest has increased very considerably during the past few years. From the life habits of the pest it would appear that growers must depend for its control on a spray of lime-sulphur applied after all the mites have hatched out.

These papers and summaries make an excellent report which is full of recommendations of real importance to all interested in fruit production.

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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NOVEMBER, 1929.

NOTES FOR THE MONTH

THE experimental grading and marking scheme as applied to home-killed beef was described in this JOURNAL for October, 1929. The scheme was put into actual operation in the London area on Friday, October 4, 1929, on the evening of which the Minister broadcast a full explanation of it from 2 L O. On the following Monday over 900 sides of graded and marked home-killed beef were offered on Smithfield Market, London, the amount of home-killed beef which had not been graded and marked being negligible. The effort to regain for the home producer a larger part of the beef trade in the London area was, therefore, launched under very favourable circumstances with the full support of the London wholesale trade. It was also favoured with a sympathetic Press. During the week ended October 12, a further 2,000 sides were graded and marked. The sides offered for grading up to October 10 were classified by the official graders as follows:—

" Select "	..	..	..	..	..	627
" Prime "	..	..	..	..	..	1,094
" Good "	..	..	..	..	..	848

The organization of the grading and marking work has proceeded smoothly, and both graders and markers have now a regular time table of duties. In addition to the public abattoir at Islington, grading has been carried out at the London Co-operative Slaughterhouses at Leytonstone and at several other private slaughterhouses in the London area. Further applications for grading and marking in London slaughterhouses have been approved and routine arrangements have been made for graders to visit these premises.

Over 1,000 posters have been distributed to retail butchers who are selling " National Mark " beef. There has been an active demand for the leaflets which explain the scheme, 6,500 copies of Leaflet No. 13 and 38,000 of Leaflet No. 13A having been distributed up to October 12.

The Department of Agriculture for Scotland are putting into operation this month a complementary scheme at some of the Scottish centres whence beef is exported to London, and on November 16, the Ministry will begin the grading and marking of home-killed beef in the Birmingham area.

* * * * *

OVER large areas of the country the drought remained unbroken until the end of September. For many weeks pastures had been brown and scorched and bare. Yet most farm animals thrive remarkably well considering the circumstances. What can be the explanation?

Drought and Pasturage

Some people say they have been less disturbed by fly pests than in other years, but flies have been less troublesome generally this year, and in parts of the North, where rain has been plentiful and grass abounds, it is doubtful whether sheep, for instance, looked as well as those on some of the dried-up pastures of the South. Is it not possible that the quality of the grass may supply some part of the explanation? The work of Dr. Woodman, of Cambridge, and others, has shown that short grass, both in fresh and in air-dried condition, has a very high feeding value. Pastures in the South have been short all through the summer, and, for lack of rain, the herbage has been eaten in air-dried form. It is true that the stock-carrying capacity of the fields has been low, and that, where the stocking has been heavy, animals have suffered from too little food. The conclusion, surely must be that such grass as has been available has had a very high nutritive value. The extra sunlight, perhaps, may have had some influence in the matter, but, on the whole, the lesson for a normal year would seem to be a greater control of grazing, so that as far as possible the herbage is maintained in a uniformly *short*, leafy state. This means an extension of the practice of grazing fields in alternation. No system short of irrigation will make grass grow in such a drought as that of this year. Almost the only forage plant that will grow and thrive in such conditions is lucerne, and if the past season will have done something to popularize lucerne, and to stimulate a closer study of the factors that make for its successful cultivation, it may yet be remembered with thanksgiving. As a supplement to dried-up pastures, lucerne is unsurpassed.

It would not be surprising if farmers were just now much less disposed than formerly to seek salvation in sowing away

to grass. The arable has been their sheet anchor this year. Even arable land grass has stood the test well. A revival of interest in temporary leys, if only for hay production, may therefore be expected. In sowing out a ley of this kind, a farmer has the inestimable advantage of being able to choose the plant species he wants, instead of having to make the best of such species as are already there. By the end of this summer, almost the only grass plant that remained green on the thin chalky Chilterns was cocksfoot. This is undoubtedly a wonderful drought resister, but it has to be sown before it will make its appearance ; and regular sowing, as in a rotation, is apt in a very dry year to result in a disappointing "take." To counteract this, some farmers in the South have adopted the expedient of sowing their seeds in autumn. Short of this, the best alternative, perhaps, would be lucerne as a more or less regular rotational crop ; if the young plant failed one year, it would probably be found that an older "stand" could be left down a further year without detriment.

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As a memorial to its late President and founder, Dr. Thomas William Cowan, the British Bee Keepers' Association acquired his library relating to bees, and made arrangements for its accommodation at the offices of the Ministry of Agriculture.

**The Cowan
Memorial
Library**

The collection, which will be known as "The Cowan Memorial Library," contains over 1,800 volumes consisting solely of literature devoted to bees and allied interests, and includes many works of antiquarian interest—some of them dating from the sixteenth century. Complete sets of various periodicals connected with apiculture are filed, together with a large number of foreign works.

The Ministry desires to place on record its great indebtedness to the British Bee Keepers' Association for this valuable presentation of what must be regarded as a unique collection of books. It is the intention of the Ministry to add to the Library as occasion arises.

The Cowan Memorial Library is now available to the public as in the case of the Ministry's main Library, and any of its contents, of which there is a card catalogue, may be consulted during the usual official hours. Many of the works may be borrowed by post on payment of 6d. to cover the cost of

packing and postage, but large works of reference, books published before 1850, and other books of special value, will not be lent.

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SPEAKING at the Court and Livery Dinner of the Poulterers' Company on October 2, the Rt. Hon. Noel Buxton, M.P., Minister of Agriculture and Fisheries, said

National Mark Scheme that there was every prospect of the National Mark scheme being applied next spring to poultry produced in England and

Wales. Progress was being made with the difficult task of drawing up standards of quality which he hoped would be promulgated in the near future. This was a further development of the comprehensive scheme of marketing reform which has already been applied to apples and pears, eggs, tomatoes and cucumbers and all-English flour. Increased efficiency in methods of marketing agricultural produce was of the utmost importance from the producer's point of view, and he had no hesitation in saying that marketing reform, and, in particular, the standardization and grading schemes which were now being developed in association with the National Mark, was the most hopeful direction in which an advance could be made towards returned prosperity for the producer in this country.

Striking results had already been achieved, particularly in connexion with the National Mark Scheme for eggs. In previous years on the London market, the best imported eggs had commanded the best prices during the summer, but this year for the first time the market prices of the best English eggs—National Mark eggs—had been above all other eggs throughout the whole summer. The National Mark scheme was improving the business prospects of the British poultry industry, and, although the day was yet young, some indication of the producer's reaction to a more favourable outlook was indicated by the remarkable increase this year in the number of fowls on agricultural holdings in England and Wales. The figures for June this year show an addition of 2,800,000 fowls, an increase of 7 per cent. as compared with June, 1928. Mr. Buxton emphasized the need for producing birds of good quality, and advised producers to concentrate on good dual-purpose breeds, and to pay special attention to conditioning for the market. There was considerable scope for profitable development in the poultry industry, provided that the produce was of good quality and was efficiently marketed.

Mr. Buxton observed that the National Mark scheme for agricultural produce was the logical development of work on marketing reform which he had initiated when Minister of Agriculture in 1924, and all concerned—producer, distributor, and consumer—stood to benefit by it, and were benefiting. The National Mark was a stimulus to the producer, a convenience to the distributor and an assurance to the consumer. The consumer in particular was now able to buy the best products of English farms and orchards, guaranteed as to quality, and in so doing not only obtained a high grade article, but kept his money in the country.

* * * * *

THERE is, as yet, no standard definition of a marketable sample of ware potatoes. In view of the variations which occur in practice in regard to the proportion of diseased or damaged tubers, and of earth and other extraneous matter, in commercial samples, it is desirable that a standard definition should be provided in the interests of producers, distributors and consumers.

Grading of Ware Potatoes

The Minister of Agriculture and Fisheries has, therefore, made draft regulations* under the Agricultural Produce (Grading and Marking) Act, 1928, prescribing and defining grade designations for voluntary use in the trade. These have been demonstrated by the Ministry of Agriculture during the past year at a number of agricultural shows up and down the country. They provide for variations in the size, i.e., minimum diameter of the tubers as between one grade and another, but for a common standard of dressing as regards disease, damage, dirt and so forth.

Owing partly to differences in public taste and partly to the difficulty in defining cooking quality, no provision is being made, at the moment, for the use of the National Mark on graded consignments. It is believed, however, that even without the National Mark the existence of a statutory standard of dressing will be as beneficial to the potato industry of this country as it has proved to be elsewhere and that, in time, such a standard will work its way into the trade on its merits.

At present, good and bad samples are marketed under the same description. By using the statutory grade designations, growers will be able to guarantee their standard of dressing

*Agricultural Produce (Grading) (Potatoes) Regulations, 1929. Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2.

GRADING OF WARE POTATOES: SCHEDULE EMBODYING THE DRAFT GRADE DESIGNATIONS & DEFINITIONS

Grade Designation	Definitions of quality						
	General	Applicable to single tubers	Applicable to quantities				
		Size (minimum diameter)	Conformity to variety, etc.	Undersize or oversize	Tolerances	Earth and/or extraneous matter	Maximum aggregate of all defects under Cols. 5, 6 and 7
(1) E. & W. No. 1 size E. & W. No. 2 size E. & W. No. 3 size	(2) Reasonably clean, healthy potatoes, free from serious defect and suitable for human consumption.	(3) 1½ in.† 1⅞ in. 1½ in.	(4) At least 95 per cent., by count, must conform to the variety as and when specified and to the type of soil on which grown, where such is declared.	(5) Not more than 3 per cent. of the total weight may pass through a middle or sieve having a square mesh of the minimum size† specified (in Col. 3) for the grade, and included in this, not more than 0.5 per cent. of the total weight may pass through a 1-in. mesh; potatoes which exceed 3½ in. in their smallest diameter shall be excluded. Otherwise in regard to size, the potatoes shall be as grown.	(6) Not more than 3 per cent. of the total weight may consist of appreciably diseased, damaged or unsightly potatoes, and included in this amount, not more than 0.25 per cent. of the total weight may be obviously affected with soft rot.	(7) Not more than 4 per cent. may be present in potatoes loaded up to November 1 in the year of harvesting, and 2 per cent. after that date; the percentage to be calculated on the net weight of screened potatoes.	(8) 5 per cent. of the total weight.

For Notes to the Table see page opposite.

NOTES TO THE TABLE OPPOSITE.

- * (i) Any disease or defect, the presence of which may be established by cutting open the potato, shall be taken into account, and potatoes having worm or slug holes penetrating into the flesh shall be regarded as damaged.
- (ii) Potatoes affected by superficial disease or damage shall not be regarded as diseased or damaged unless more than one-tenth of the surface is so affected.
- (iii) A potato shall only be regarded as being obviously affected with the soft rot if, at the time of inspection, it is squashy and/or the surface is at some part distinctly broken or wet owing to disease.

† When the potatoes have been passed over a riddle of greater mesh than $1\frac{1}{2}$ in., the minimum size may, at the seller's discretion, be appended to the grade name, e.g., "E. & W. No. 1 (2 in.)."

‡ As measured clear within the bounds of the mesh.

which should go some way towards securing them from the competition of poorly dressed lots. Merchants, both wholesale and retail, and public or private institutions accustomed to buying large supplies should find the grades helpful.

The extensive use of these grades in conjunction with the excellent quality of this year's crop would help to stimulate the demand for home grown potatoes, and would be an obvious and proper departure from the present condition of informality and uncertainty.

* * * * *

THIS Council, whose President is the Speaker of the House of Commons and whose Vice-President is the late Speaker, was

**The National
Council of
Social Service**

formed in March, 1919, and has thus completed ten years' work. It has become increasingly well-known throughout England and Wales, mainly, perhaps, because it is the parent and guide of the Rural Community Council movement. In England and Wales there are now 17 Rural Community Councils which, through voluntary efforts and some assistance from the Development Fund and the Carnegie Trustees, help the development of rural industries and assist in providing plays, music, lectures and other matters of interest to country dwellers. From the farming point of view their chief usefulness is perhaps in the encouragement of industries subsidiary to farming, especially such grand old industries as those of the village blacksmith and village carpenter. The work of the Councils does not end there; it extends, indeed, to any voluntary social work

that requires to be done in a county, such as assisting the youth through the Young Farmers' Club movement and taking a hand in county health work.

The National Council also administers the Village Halls Loan Fund, which was created by the Government some few years ago to see to what extent practical help could be given to villages in the excellent purpose of erecting village halls. The Fund is at present operating only in counties where Rural Community Councils have already been set up. It is of much value to the social life of a village that it should possess a suitable village hall, where lectures, debates, exhibitions, dances, whist drives, concerts and so on can be held. It is therefore important that village halls should be established as widely as possible in our country districts.

It is impossible to do justice to the National Council in a short notice. Those who are interested can and should read a plain tale of achievement in the Annual Report of the Council, "Co-operation in Social Service," which can be obtained from the Council's office at 26 Bedford Square, London, W.C. 1, price 6d. Its monthly organ is the *Social Service Review* (annual subscription, 5s.) which contains various interesting articles, many of which provide much-needed inspiration for the solitary country worker.

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In view of the suggestions put forward in the Ministry's Report on the Marketing of Wheat, Barley and Oats (Economic Series No. 18) in regard to the

**Grain
Marketing :
Recent
Developments
in Germany**

adoption of a recognized f.a.q. (fair average quality) standard for English wheat, with a fixed range of premiums and discounts for samples falling above or below this standard, it is interesting to know that the Rhenish Corn Exchanges, including those at Aachen, Dusseldorf, Duisburg, Essen, Cologne, Crefeld and Neuss, have come to an agreement on similar lines with regard to the principles of standardization of bread cereals. In future, the exchange quotations for wheat and rye are to be made on the basis of a hectolitre of *average quality*. Variations from the standard will be recognized according to a special scale of prices. For the current year this regulation will apply to wheat only.

ELSEWHERE in this issue (p. 700) will be found a report of an announcement made by the Minister of Agriculture and Fisheries concerning the National Mark Scheme and its probable application in the spring of 1930 to dressed poultry (clean picked for market). The further extension of the scheme now in prospect, and its development in respect of those commodities to which it is already applied, make it clear that, although only about a year has passed since the first application of the scheme to home-grown apples and pears, and although it remains a purely voluntary scheme, it has firmly established itself in the sphere of agricultural marketing.

Egg Scheme.—Some idea of the extent to which the National Mark Egg Scheme has been operative may be gauged from the fact that, since the inception of the scheme in February last, approximately one million box labels and one and three-quarter million carton labels have been disposed of. As each box label represents either 15 dozen or 30 dozen eggs, and each carton label either half-dozen or one dozen eggs, it may be estimated that as many as 200 million eggs produced in England and Wales have been packed under the Mark during that period. National Mark eggs now definitely and consistently make top prices on the wholesale markets, and despite the fact that the present autumn shortage of home-produced eggs, accentuated by the effects of the marking of imported eggs, has created a very difficult situation in many respects, there exists, in general, a spirit of healthy optimism and a belief that with the coming of the spring there will be wide developments in the National Mark Scheme. It is significant that there have lately been reported several instances of amalgamations between producers' co-operative societies and individual egg packers, which should lead to the more effective operation of the scheme in the areas concerned.

Reference should be made to two matters which will doubtless have an important influence. In the first place, steps have recently been taken by the National Mark Committee to ensure that all packers registered in the scheme will be, in fact, effective packers of National Mark supplies. A new condition has been imposed upon all registered packers requiring them to pack a certain minimum proportion of their output of home-produced eggs under the Mark. This has led to the removal from the List of Registered Packers of those who were unable to comply with the new requirement. The existing registered

packers, now numbering 164, may therefore be relied upon to give effective support to the scheme and to be keenly interested in its development.

The second matter of interest was the holding of a Conference of Registered Packers in London on October 24 and 25. Much useful preliminary work has been done by packers who had organized themselves in districts, and had held area meetings to consider matters which they wished to be discussed at the main London Conference. The proceedings were opened on the first day by the Minister, and consideration was given to such matters as the formation of a federation of authorized packers, the compulsory sale of eggs by weight, the present statutory grades, the establishment of selling agencies in consuming centres, the collection of market intelligence, &c. It is proposed to include in the December issue of the JOURNAL a summary of the proceedings at the Conference.

Apple and Pear Scheme.—During the present apple and pear season there has been every indication of the successful marketing of supplies under the Mark. Since last year the regulations and conditions governing the scheme have been revised in certain particulars (see this JOURNAL, June, 1929), but with four exceptions all last year's authorized packers renewed their registration. Additional packers have also been authorized to apply the Mark, and the number of authorized packers in the Apple and Pear Scheme is now 61 as against 52 at the end of last season.

It is interesting to note that a Covent Garden firm of salesmen has been sending National Mark "Fancy" grade pears to Paris. In the near future this same firm expects to ship National Mark boxed apples to South Africa.

The accompanying photograph shows a striking display of National Mark fruit at Covent Garden, where there is a brisk demand for these supplies.

Another good example of the demand for National Mark produce is afforded by the sale of apples under National Mark labels at the North East Coast Exhibition, Newcastle-on-Tyne, during the four weeks August 26 to September 21. These apples were sold from the Ministry's Stand direct to the public, and the weekly receipts during that period were as follows:—

First week	..	..	..	£62	5	5
Second week	..	..	..	£68	18	3
Third week	..	..	..	£84	7	8
Fourth week	..	..	..	£99	14	3



A striking display of National Mark Fruit at Covent Garden.

THE USE OF HAY FOR DAIRY COWS

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PROBABLY no feeding stuff has been used so extensively and over so long a period as hay ; and it is strange, therefore, that, generally speaking, its relative feeding value is not better appreciated, and that comparatively few farmers either handle it or feed it to cattle with the intelligence that efficient use demands. This question of efficient use becomes doubly important at the present time since hay in England and Wales is generally very scarce. It may be opportune, therefore, to indicate how existing supplies can be utilized to the best advantage.

Value of Hay.—Before doing this, however, it is desirable to consider some points about the value of hay as a feeding stuff. It must first be realized that the feeding value varies very much with the type of hay, the time it is cut and the conditions under which it is harvested. As an example, good meadow hay, cut in June and harvested in good condition, will have a starch equivalent of 35 and a digestible protein of $4\frac{1}{2}$, so that 2 lb. of such hay is equal in feeding value to 1 lb. of barley meal or similar cereal foods.

Poor hay, however, particularly if late-cut, may have a starch equivalent of only 18, and a digestible protein of $2\frac{1}{2}$. It would, consequently, take about 4 lb. of this poor hay to equal 2 lb. of the good hay or 1 lb. of barley meal. It will be seen, then, that a cow receiving 20 lb. of good hay for maintenance is getting the equivalent of 10 lb. concentrated food such as cereals ; and that, if poor hay is fed, 20 lb. represent a concentrate value of about 5 lb. only, the difference to the cow being 5 lb. of concentrates, or a starch equivalent equal to her requirements for producing $1\frac{1}{2}$ gallons of milk. On poor hay, therefore, she would require feeding for $1\frac{1}{2}$ gallons of milk more than if she were receiving good hay. It may be mentioned that seeds hay, if cut young, can be taken as almost equal in value to good meadow hay.

The necessity for harvesting hay when young is thus clearly demonstrated, since two tons of early-cut hay is equal in feeding value to four tons of late, poor quality hay. Moreover, as the young hay contains much less fibre, the digestive troubles experienced by the cows will be proportionately reduced. It is better to have early-cut, weathered hay than late-cut hay well got.

Most of the feeding value in hay is contained in the leaf, and it follows that as little of the leaf as possible should be lost in the making. A good deal of value, however, may be, and often is, lost through the hay being allowed to heat after it is in the stack or shed. Farmers should realize that when hay is fed to cattle for maintenance, its chief function is to generate heat, and that heat generated in the stack reduces the amount of heat available to the animals. Heated stacks or ricks may lose as much as 30 per cent. of their total value, but waste of this kind can be prevented by ensuring that the hay is cured sufficiently and dry before stacking.

As this year's hay harvest is over, the foregoing notes can only be taken as a guide for the future.

Use of Hay.—Many farmers are facing the winter with very short supplies, and the urgent problem for them is whether they have enough to see them through the season, and, if not, how their stock can best be supplemented.

Assuming that there is a definite deficiency, then the following may be taken as suitable supplements:—

3 lb. good silage	equal 1 lb. good hay.
2 „ sugar beet pulp	„ 3 „ „
1 „ cereals	„ 2 „ „
2 „ brewer's grains (wet)	„ 1 „ „
3 „ roots + }	„ 1 „ „
1 „ oat straw }	„ 1 „ „
1 „ sugar beet pulp + }	„ 2 „ „
1 „ straw }	„ 2 „ „
4 „ sugar beet tops	„ 1 „ „

Twenty pounds of hay form the standard requirement for maintenance of the average cow, so, by using the above equivalents, the following illustrations will show how part of the hay may be replaced:—

(1) *Silage as part substitute*

8 lb. hay plus 36 lb. silage.

or 10 „ „ 30 „

or 14 „ „ 18 „

(2) *Sugar Beet Pulp as part substitute*

14 lb. hay plus 4 lb. sugar beet pulp.

(3) *Cereals as part substitute*

14 lb. hay plus 3 lb. cereals.

(4) *Brewer's Grains (wet) as part substitute*

10 lb. hay plus 20 lb. grains.

or 14 „ „ 12 „

(5) *Roots and Straw as part substitutes*

10 lb. hay plus 10 lb. oat straw plus 30 lb. roots
 or 7 " " 14 " " " 42 "

(6) *Sugar Beet Tops as part substitute*

14 lb. hay plus 24 lb. sugar beet tops.

Numbers 1 and 4 will apply principally to the grass farms, and numbers 5 and 6 will apply only to farms having arable land where corn and roots or sugar beet are grown.

Where the hay substitute has to be purchased, sugar beet pulp will generally be found the most efficient, but farms situated near a brewery will, as a rule, find that brewer's wet grains work out much the cheapest.

Economy in the use of hay may also be attained by cutting short the winter feeding period. This can best be done by preparing a field for an early bite by dressing a good pasture in late January with 1 cwt. of sulphate of ammonia per acre, so as to have grass about three weeks earlier in the spring.

Before deciding which of the supplements is best suited to his conditions, a farmer should consider whether, by strict economy in the feeding of his hay, the use of a supplement may not be avoided. There is good reason for suggesting this consideration, as, on the average, far more hay is used than is required; and on some farms actually double the necessary quantity is consumed. This excessive consumption is not only wasteful, but it is definitely harmful to the cows, and also reduces their milk yield. Considerable wastage may also occur through hay left by cattle going down for bedding, eventually reaching the manure heap.

Of these two waste factors, the excess consumed by the cow is by far the greater, and this overfeeding with hay has a serious result. A cow can deal efficiently with only a limited amount of food, although, if given the chance, she will very probably consume up to about a third more food than she actually needs; and the usual result of an excess of food is a diminution of the milk yield. In other words, the quantity of food that she can efficiently utilize is reduced by feeding her in excess of her real requirements.

Let us take an illustration. An average cow of about 11 cwt. live weight, if fed on hay and concentrates, can usually deal with a total of 30 lb. per day. If a cow of this type be allowed hay *ad lib.* she will probably consume in food about 40 lb. or more a day. She will not deal efficiently with this 40 lb., and will, in fact, utilize even less than the 30 lb. that constitutes her normal requirement—so that the 10 lb. of

excess food she has obtained results in the digestion of less than her usual ration.

In herds where hay is not rationed (and they are very much in the majority) this wastage of 10-12 lb. of hay per cow occurs daily, and works out to about 1 ton of hay per cow per winter.

From the foregoing, it will be evident that if cows are rationed with concentrates in accordance with their milk yields, the quantities of concentrates given will vary; and it follows, obviously, that if the hay is not also rationed, the total amount of food given to the higher yielding cows will be excessive. The table following sets out the quantities of food to be fed to cows of different yields, assuming 20 lb. of hay as a standard maintenance ration with $3\frac{1}{2}$ lb. of concentrates for the production of each gallon of milk.

Yield gal.	Concentrates lb.	Hay lb.	Total food lb.
2	7	20	27
3	$10\frac{1}{2}$	20	$30\frac{1}{2}$
4	14	16	30
5	$17\frac{1}{2}$	12	$29\frac{1}{2}$
6	21	9	30
7	$24\frac{1}{2}$	6	$30\frac{1}{2}$

From this table it will be seen that, after 3 gallons yield, the hay is reduced as the concentrates are increased.

It must be remembered that cows vary in their capacity. Smaller cows such as Guernseys and Jerseys have a total capacity of from 24 to 28 lb., Shorthorn heifers about 26-28 lb., average Shorthorn cows, 30-33 lb., average Friesians, 30-36 lb., and one may get exceptional cows with large middles that can deal with up to 40 lb.

It may be objected that a cow giving 6 gallons and getting only 9 lb. of hay, is not receiving a sufficient amount for maintenance; but it must be realized that a cow cannot utilize for the production of milk the whole of the food digested, and that the balance serves for maintenance. In other words, the production ration always supplements the maintenance ration; consequently, the larger the production ration is the more it supplements maintenance, and the smaller will be the amount of the maintenance ration required.

Weighing the Hay.—If the hay is to be fed intelligently, then it is obvious that the cowman must know by practice the various weights of hay that he must feed to individual cows—exact amounts varying from 2 to 10 lb. per feed—

and he cannot be called efficient until he has mastered this part of his duty. Once, after giving a lecture which embodies the point of the last paragraph, the writer was asked by a farmer, in the presence of his cowman, to visit his holding on the following day. On arrival at the farm, the writer asked the cowman to pick up 4 lb. of hay: this he did immediately, picking up the correct amount. On being asked how long he had been able to do this, he replied: "I heard what you said last night, and knew you were coming, so had half an hour's practice this morning." That man learnt more about his job that morning than he had ever done before! One sees cowmen giving hay to cows with a fork; it would be equally sensible to feed concentrates with a shovel.

Many people are under the impression that the higher yielding cow, which is receiving a larger quantity of concentrates, will, by her own intuition, reduce her consumption of hay in proportion to the increase of the concentrates, but this is not the case. The high yielding cow, receiving a large quantity of concentrates, will eat more hay if allowed to do so, and thus become overloaded, of which she will show signs by lying down and grunting. Grunting means indigestion, not comfort as one often used to hear. Indigestion means less milk and a lowered constitution; also that much food which should be digested and converted into milk is simply wasted by conversion into manure.

An Experiment for Farmers.—Farmers who have doubts respecting these views are advised to try the following experiment. Take a newly-calved cow; ration and control the total amount of her food. Should she one day attain six gallons, let her have hay *ad lib.* instead of the control ration of 9 lb. Her yield will drop immediately. Let her be fed like this for three days, by which time she will probably be down to 5 gallons; then revert to the control amount of hay, and within two days her yield will be back to the figure from which it had dropped. Many farmers have realized that the concentrated ration should be fed according to yield, but few have grasped the absolute necessity of controlling the *total amount* of the food given.

Where concentrates are rationed and there is no control on the amount of hay fed, the farmer is probably worse off than before because the higher yielding cows are not utilizing efficiently the larger amount of concentrates fed to them, and because of the greater amount of indigestion among the cattle, which leads to loss of milk.

Probably, more milk is lost, more concentrated food wasted, and more cows debilitated by improper hay feeding than from any other cause. This year's shortage, though serious, may do very much more good than harm if it will but lead the farmer to practise economy in his use of hay.

Where roots are used, it must be borne in mind that they increase the cow's appetite for hay, and, if the hay is not rationed, she will eat more of it than if roots were not fed. As 30 lb. of roots have a starch equivalent equal to 5 lb. of hay, there should be a saving of hay to that amount; but if there is no control of hay, the cow will increase her consumption of it by about the same amount (5 lb.), so that, in feeding roots, strict control of the hay is more than ever necessary.

A True Story.—The following true story may serve to illustrate the importance of hay control. A farmer came to see the College experimental herd, which, by the way, during the last milk recording year, averaged 1,300 gallons per cow. The hay feed to the herd is controlled, and the visitor was impressed by the rationing arrangements. Two months later, he came again; this time with his two sons. He had, in the meantime, rationed his cows, but with little benefit because he had not controlled the hay, although he could not be persuaded that this was the cause of the non-improvement. However, as the sons wanted to try the experiment, he allowed each of them two cows for the purpose. The boys started then to weigh both the concentrates and the hay; very shortly after, all four cows were giving higher yields than had ever before been obtained on the farm. The farmer then offered a prize to the son whose cows gave most milk during the following week. By the Wednesday night of the contest, it was fairly obvious that the cows of one boy were coming out on top, but, unfortunately for him, they dropped away rapidly at the end of the week, and his brother won. The latter eventually owned up that he had won by unfair means; the unfair means being that he had gone out late on the Thursday, Friday and Saturday nights and given his brother's cows some more hay. Now, both father and sons are in no doubt about the value of hay control.

A GRASSLAND DAIRY SMALL-HOLDING

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SEVERAL seasons' experience of a recently-introduced system of grassland management, had suggested to the writer that for full efficiency such intensive management as is associated with the system appeared to be peculiarly well adapted to the farming methods of a small-holding.

The high stock-carrying capacity of intensively farmed grassland would hold out to the small-holder possibilities of return denied to him on grassland holdings under ordinary methods of farming. The detailed supervision and the intricacies of management which the new system involves, and which are essential for maximum success, appear also to be more easily obtainable under small-holding conditions where the whole of the farmer's time can be given to the proper farming of the grassland.

To put these matters to the test, a small-holding was established on the College farm in the autumn of 1927. It consisted of 25 acres of moderate grassland and 1 acre of woodland. The lay-out of the holding for the purposes of farming is illustrated in Fig. 1.

The holding consists of 8 grazing paddocks, each approximately 2 acres in area, and a hayfield of 10 acres. The holding is not particularly well situated for dairy-farming purposes, being $1\frac{1}{2}$ miles from the nearest road; the grazings face south with a considerable slope; and the hayfield is very steep, with a northerly aspect. A rent of £31 10s. 0d. was charged for this land in its unimproved state, without buildings, water supply or fences. Farm buildings, with all necessary outhouses, were erected at a cost of £544, to accommodate 21 cows; and a water supply was found on the site which was sufficient to meet the needs of ordinary farming requirements. A great deal of fencing was necessary, and this, with other initial costs, appears in the balance sheet of the year's working.

Manuring.—In the autumn of 1927, the grazing paddocks were dressed with lime at the rate of 30 cwt. of limestone per acre, and shortly afterwards the whole holding received an application of 2 cwt. superphosphate, 4 cwt. basic slag, and 3 cwt. of 20 per cent. potash salts, per acre. It was anticipated

* General information relating to soil, altitude, position, etc., were discussed in this JOURNAL for March, 1929.

that the farm buildings would not be completed until May of the following year, and in order not to lose the value of the early grazing, pre-entry was obtained and a flying flock of sheep was carried during the winter of 1927-28, and fattened out for the early spring markets. Keep was obtained for this purpose in February and March by autumn applications of nitrogenous fertilizers on the first five paddocks.*

The eight paddocks were top-dressed with 2 cwt. nitro-chalk per acre in April and May, in a sequence that allowed of a week's interval between the applications to the respective paddocks. It was hoped in this way to obtain a sequence of grazing, and to some extent this was realized.

General Management.—The first cows were purchased on April 23, and the last of the sheep were sold on May 22, by which date the herd consisted of 8 cows. By the time the farm buildings were completed in early June, the dairy herd consisted of 13 cows, and the total stock on the holding comprised the cows, 2 horses, and a bull. The size of the herd is not necessarily any indication of the stock-carrying capacity of the holding; but represents the number of cows it was found necessary to keep in order to maintain an output of from 40-50 gal. of milk per day. The size of the herd was limited by (1) the necessity for cutting one or two of the paddocks for hay, (2) the lack of building accommodation early in the year, this necessitating the letting of part of the grazing at a figure which was far from remunerative.

It was realized from its inception that the whole of the farming operations must be conducted with due regard to the limited pocket of the small-holder and to nothing did this apply more than to the purchase of the dairy herd. On an intensively farmed holding, it may be argued that stock capable of high production are essential; but while this may be desirable it is often impossible for the small man to consider on account of the expense involved, and because of the dangers of over-capitalization. Accordingly, a small-holder's type of cow was aimed at, and, regardless of breed, dairy cows were purchased in the local markets as cheaply as possible. The average price paid was £27 5s. 0d. per cow—several pounds below the average cost of cows on the larger farms in the same district.

The great expense incurred in artificial fertilizers, and the comparatively high rent, gave reason to doubt the efficacy of

* See this JOURNAL, March, 1929.



FIG. 3. Showing the evenness of the sward and the complete absence of tufts.

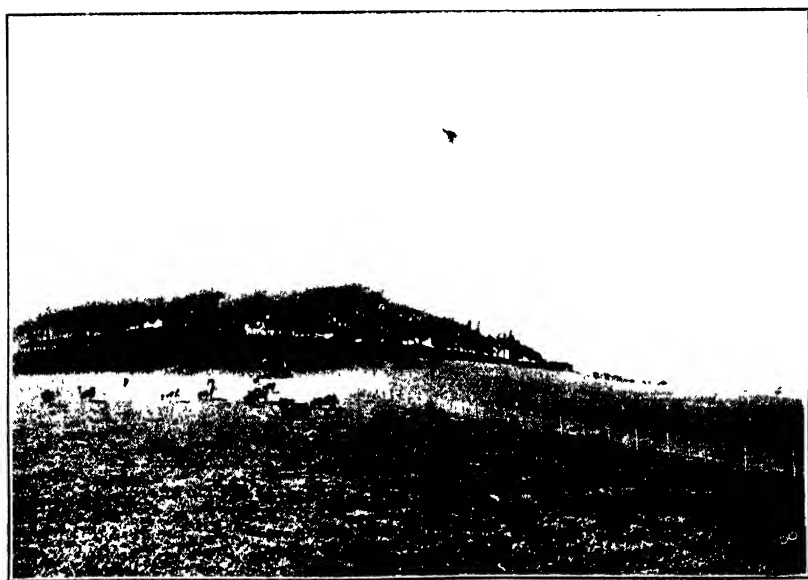


FIG. 4.--General view of the herd grazing in one of the paddocks.

ordinary methods of stocking. After much careful trial an entirely new system was evolved, which consisted in part of ordinary practice, and in part embodied the principles of tethering. The herd was allowed into a fresh paddock for only one hour after each milking; after which time the cows went into a paddock that had already been partially grazed. This is illustrated in Fig. 2.

TABLE I

Paddock 2	3	4	5	6
Aug. 22	Aug. 22	Aug. 28	Sept. 2	Sept. 8
Herd	Herd	Herd	Herd	Herd
following	grazing	grazing	grazing	grazing
from	for 1	etc.	etc.	etc.
P. 3.	hour			
	after			
	milking			
Aug. 28	Aug. 28.	Sept. 2.	Sept. 8.	
Paddock	Herd	Herd	Herd	
harrowed	following	following	following	
and if	from	from		
necessary	P.4	P.5		
top-				
dressed				
	Sept. 2.	Sept. 8.		
	Harrowed	Harrowed		
	and top-	and top-		
	dressed.	dressed.		

The herd was milked three times daily, so that they had three feeds of young succulent grass, each feed of very limited duration. The remainder of the day they were clearing up an already half-finished paddock. Great advantages accrued from this system of stocking, and appear to be fundamental for maximum efficiency under such a method of grassland farming. They were as follows :—

- (1) A paddock was made to give 5 or 6 days' first-class keep, at the end of which period the best of the grass had gone and the paddock still remained unsoiled so far as any droppings were concerned. On no occasion throughout the year was there any dunging on the paddocks during the time they were giving first-class keep. This was conducive to great saving in herbage.
- (2) Milk yields were maintained at a remarkably high level throughout the summer; due in part no doubt to the fresh nature of the first-class keep. The herd average for the year under review was 811 gal.
- (3) No following stock were necessary. The dairy herd cleaned up the paddocks after themselves, and an

outstanding feature of the grazings was the very even sward maintained. This may be seen in Fig. 3, a photograph taken in July.

- (4) The period during which the droppings of the herd remained on the grazings unspread was considerably shorter than would have been the case had following stock been employed and a different system of stocking observed. This facilitated very effective harrowing results, and there was at no time difficulty in the distribution of the dung.

A paddock was considered fit for stocking when there were several inches of young fresh herbage available. Generally a total of from 8-11 days' keep was obtained from each paddock; 4 or 5 days of fresh keep for the dairy cows, and 4 or 5 days of following keep. It was thus possible to rest each paddock from 4 to 6 weeks before it was again needed for grazing. The intervals of resting were carefully considered. It was realized that the high feeding value of the grass was prejudiced immediately it passed beyond a certain stage of growth, whilst too short a time would give insufficient keep for the needs of the stock. Analysis showed that after a 5 weeks' resting stage the grass remained a comparatively rich protein food; and this was, with few variations, the average time of resting. On unmanured land, it has been shown that after a period of 3 weeks' resting, grass loses some of its feeding value, and that for fullest efficiency in management this must be regarded as the maximum time*.

It seems reasonable to suppose, from the instance under review, that applications of nitrogen may result in conferring two qualities of value:—

- (1) The prolonging of the period during which the grass maintains its high protein content;
- (2) The delaying of lignification and consequent loss of digestibility.

Close grazing conditions were observed throughout the summer. After the grazing down of a paddock, harrowing—and frequently cross-harrowing—was necessary to dispose of the droppings. On the average an application of nitrogenous fertilizer, equivalent to $2\frac{1}{2}$ cwt. sulphate of ammonia, was given to the grazing land in the course of the year. Some paddocks received as many as four dressings of nitrogen,

* Woodman : *Jour. of Agric. Sci.*, April, 1929.

each at the rate of 1 cwt. per acre, and some had none other than the original spring application. Only under favourable climatic conditions was nitrogen employed, or at such times as there was good reason to anticipate an economic response to the application. Sulphate of ammonia was used for all spring and autumn dressings, but nitro-chalk was preferred for the top-dressings applied in summer as being quicker in its action and more productive in its effect.

Feeding of the Herd.—A great deal of the success of the holding as a farming venture was to depend on the output of cheap milk from the grazings. Two factors, output and cost, had to receive the most careful consideration. It was expected to obtain the former by the selection of a good type of cow, by the practice of three times milking (which effectively fitted into the labour economy of the small-holding), and by providing a constant change of fresh keep weekly throughout the grazing season.

The costs of producing this sequence of herbage were considerable, but the method of stocking employed was conducive to its economical consumption. It has been shown that, under experimental conditions, young grass of the nature obtained is of very high feeding value, and that its high protein content is a constant feature, almost regardless of the time of the year that such herbage is produced.*

Dr. Woodman's results have been largely confirmed analysis showing the grass of the small-holding to conform to his standards. There was no evidence, however, to show that full advantage could be taken of this rich feed in the management of the herd, and that feeding over the third or fourth gallon of milk with essentially starchy foods would not lead to a falling off in milk yields, or to a loss in condition of the cow. In April, 1928, the herbage had a protein content capable of meeting the needs of a 6-gal. cow, but with a starch equivalent only sufficient for slightly over 4 gal. For a variety of reasons it was considered, during this first year's working, to be inadvisable to rely on the grass for more than 3 gallons; and in order to test the applicability of recent research work to farming practice two groups of cows were selected all at the same stage of their lactation.

Group A were fed on a balanced mixture of concentrated foods containing 22 per cent. of protein, allowing

* Woodman : *Jour. of Agric. Sci.*, XVI, 1926.

4 lb. of the mixture for every gallon of milk over the third.

Group B were fed on a mixture of foods containing only 12 per cent. total protein. Here also 4 lb. of the mixture were fed for every gallon over the third.

The mixture fed to Group B was made to balance with the grass strictly according to the average of several analyses. For the purposes of simplicity in feeding, and because of very limited storage and mixing space, both cake mixtures were made up in the form of nuts by a prominent cake firm. The feeding trials were conducted over two distinct periods; the first commencing on June 4 and finishing on July 14, the second covering the time between August 12 and October 6.

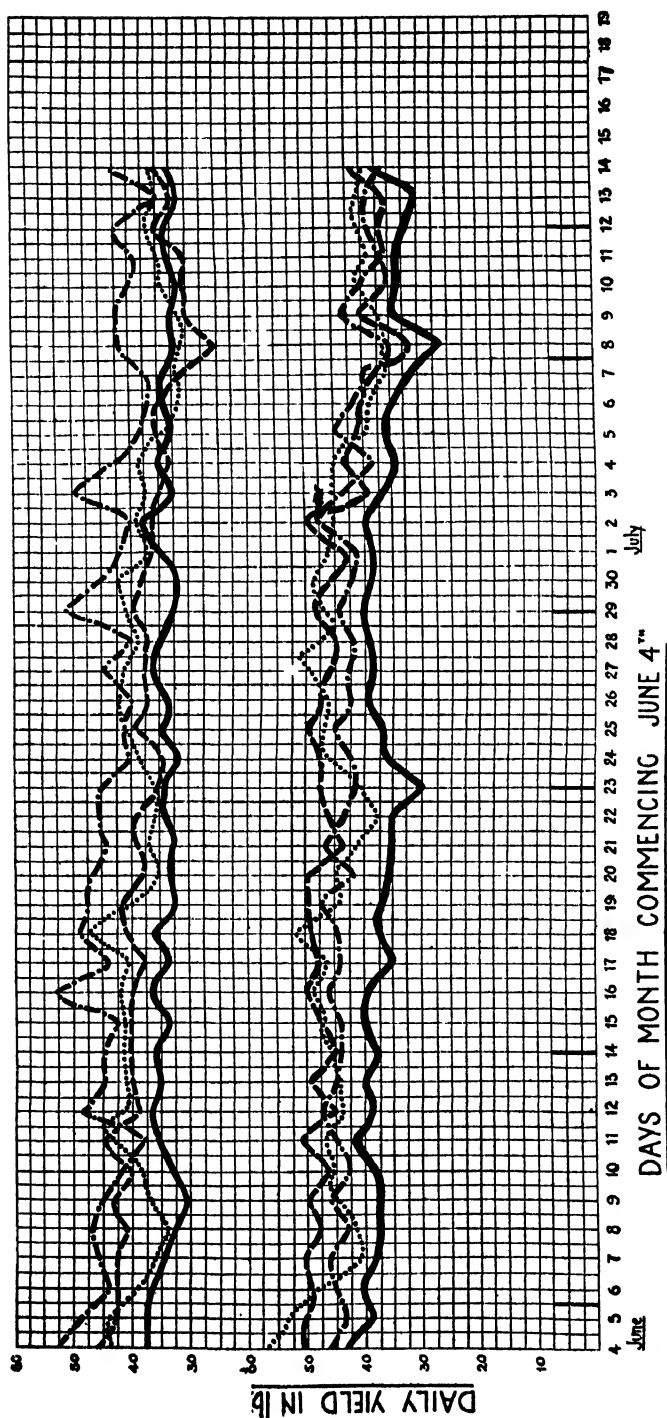
The graphs, Figs. 4 and 5, illustrate the results obtained.

A detailed analysis of these graphs is not within the scope of the present report, but their broad interpretation is of some significance to practice and requires comment.

It will be seen that those cows fed consistently on the 12 per cent. protein cake have held to their milk at least as well as those cows receiving the balanced cake containing 22 per cent. protein. Actually the unbalanced cake has shown a decrease in milk yields over the period June 5 to October 7 of only 19.4 per cent., whereas the balanced cake shows a decrease of 21.4 per cent. The main feature of the feeding has been to demonstrate that the high protein content of this type of grass can be made use of in the economical feeding of the herd. There is no need to supplement such grass with a cake, and usually an expensive cake, rich in protein. In the present instance, results in every way comparable to those obtained by a balanced cake, have been obtained by using a cake essentially starchy and costing appreciably less per ton.

The feeding trial was interrupted in the middle of July for a period of 3 to 4 weeks, when, as the result of a prolonged drought, it was not possible to obtain 3 gal. from cows on the grass. During this period the cows received cake over the second gallon, and eventually over the first gallon of milk; but the grass regained its normal output early in August. The eight cows under trial received their respective cakes as usual during this period.

In the early spring, it was found to be necessary to supplement the feeding with an allowance of cotton cake to prevent scouring. From the middle of May onwards, the only difficulty that occurred in this respect was in the case of the cows in



NOTE.—See Key indication on p. 721.

FIG. 5.—Cake Feeding over the 3 gallons.

Group A, and periodical scouring was common with them throughout the summer. The cows on the low protein cake gave no trouble in this respect after the first spring flush of grass had gone.

It is interesting to note, in Fig. 5, the drops in the milk yields of the individual cows after they had been on a paddock for any length of time, and the corresponding rise in yield shortly after their change on to fresh herbage. The period June 29-July 7 illustrated this particularly well. In Fig. 6, covering a period when a far more regular change of keep was available, and where cows were only on a paddock for 5 or 6 days, no such violent fluctuations in yield are shown. It would seem, therefore, that to maintain summer milk yields under any system of management where the advantages of rotational grazing are being exploited, that success will be in proportion to the number of changes of keep available, or in other words that 7, 8, or even 9 separate grazings are necessary to allow of sufficient change of keep so that only a few days' maintenance are required from the grazing whilst, at the same time, allowing other pastures sufficient rest to recover.

The grazing season extended until November 23, but the quality of the grass showed some falling off during September. Cake feeding over the 3rd gal. of milk continued until September 5, after which time the grazings supplied only maintenance and 2 gal., and from mid-October onwards to November 23, the output of the grass was on a maintenance and 1 gal. standard.

Winter Management.—The maintenance of the herd during the winter was one of various difficulties that might operate against the success of the holding.

The 10 acres of meadowland were obviously insufficient to maintain a herd of 15 cows, 1 bull and 2 horses through perhaps a long winter period, although it was hoped to improve output from this field by nitrogenous manuring, and by regularly dunging it with the yard manure produced during the winter. It has already been mentioned that the summer stocking of the grazings did not represent the total stock-carrying capacity of the 15 acres under treatment. Paddocks 7 and 8 were early laid up for hay, and a crop estimated at 6½ tons, was taken from these paddocks in late June.

The meadow received a top-dressing of 1 cwt. sulphate of ammonia per acre in February, and a 17½ ton hay crop was

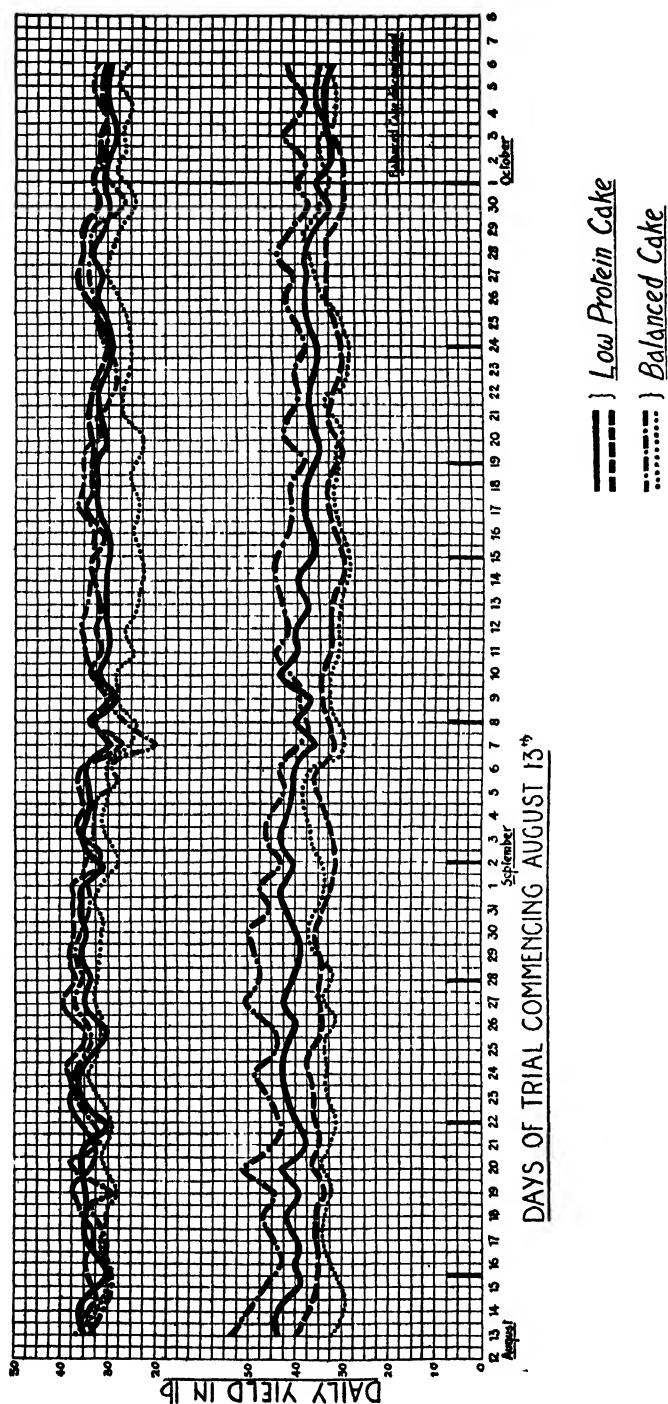


Fig. 6.—Cake feeding over the 2 gallon after September 5th.

NOTE.—Dates when cows moved into a fresh paddock are indicated by short black vertical lines.

weighed from this field. The total output of hay from the holding was, therefore, 24 tons, and this proved ample to maintain the stock until turned out in the following mid-April.

The winter rations of the herd consisted of a maintenance ration of hay, with a concentrated mixture, varying from time to time in composition, and fed at the rate of from $3\frac{1}{2}$ -4 lb. per gal. of milk. Three times milking was continued only with the best cows during the winter; the daily output of milk throughout this period varying from 27-30 gallons.

Litter had to be purchased, and various means of economizing in this were tried. Many farmers in the South-West resort to chaffing as a means of saving litter, and this method was thoroughly tested, but was found to involve greater labour in preparation than was saved in actual litter. Possibly the use of a hand-machine accounted for this. Litter was used long, and only $4\frac{1}{2}$ tons were needed with all stock through a difficult winter.

Comments on Balance Sheet.—No credit has been taken for

- (1) Unexhausted value of basal manures.
- (2) Unexhausted manurial value of cake fed.
- (3) Valuation of hay and straw in stack at close of year.

The total cash available from the holding on the year's working is £284 10s. 2d., or £11 7s. 7d. per acre. From this the small-holder would have to meet wages, and his costs of living. The holding is worked by one man and one part-time man or boy, the wages of the latter in this instance being £54 7s. 5d.

Expenses incurred under "other payments" were considerable, largely owing to the fact that the first full year's working of the holding involved much expenditure that should not recur.

The prices received for milk were as follows: summer milk, 1s. 2d. per gal. net; winter milk, 1s. 6d. per gal. net. These represent the prices of the district and are good. The favourable financial result is no doubt partially due to these prices, although on the other hand the holding has borne the cost of the heavy manuring in one year, and has had heavy charges to meet for haulage and for travelling expenses which the small-holder would not have incurred.

The total output of the 25 acres comprising the holding has been :—

- (1) The maintenance of a dairy herd of 14 cows, 1 bull, and 2 horses,
- (2) The production of 10,688 gal. of milk—426 gal. per acre over the whole holding.

BALANCE SHEET

EXPENDITURE				INCOME			
	£	s.	d.		£	s.	d.
Livestock :				Livestock Sales :			
2 Horses and float		50	0 0	4 Cows and 9 calves	90	14	4
14 Cows	404	9	6	1 Bull	35	0	0
5 Cows and 1 bull	164	3	6	Cow and 2 calves	25	10	0
Sheep	194	5	0	3 Calves	20	0	0
Feeding Stuffs :				Shoop	235	3	2
Cake	191	10	6	Milk Sales :			
Straw for litter	20	0	0	10,668 gal.	703	9	0
Manures :				Other Income :			
Sulphate of ammonia }	27	10	0	Keep of bullocks	14	8	0
Nitro-chalk }				F.Y. Manure	10	0	0
Basal manures.. .. .	85	15	0	Feeding stuffs	5	8	0
Deadstock :				Horse hire	6	10	6
Implements, churns, and float	44	1	11	Closing Valuation :			
Rent and Rates.. .. .	31	10	0	2 Horses	40	0	0
Other Payments :				14 Cows	404	9	6
Haulage	29	0	3	Implements	40	1	11
Milk for calves	11	9	1				
Harness	2	11	1				
Shoeing	2	8	9				
Utensils	2	9	8				
Vet.	17	2	6				
Thatching	5	4	6				
Subs. and advt.	3	10	6				
Sundries	1	18	9				
Travelling exs.. .. .	23	0	0				
		90	4 1				
Other charges :							
Buildings 5 per cent. and Fencing 10 per cent. on capital outlay	33	14	9				
		1,346	4 3				
Wages or family maintenance	163	2	3				
Net profit over and above family wages	121	7	11				
		284	10 2				
		<u>£1,630</u>	<u>14 5</u>				
					<u>£1,630</u>	<u>14 5</u>	

- (3) Bullock grazing to the extent indicated,
- (4) The production of 24 tons of hay,
- (5) The provision of certain sheep keep in the spring.

The high cost of fencing was occasioned in part by the indifferent state of the boundary hedges at the time of entry to the holding, and in part to the decision to erect fencing suitable alike to cattle and sheep.

Summary.—Arising out of this work the following points are of general interest :—

- (1) That the principles of rotational grazing are sound, and that a succession of fresh grazings of high-class feed can be obtained throughout the summer by this means.
- (2) Under proper conditions of management the herbage prevailing under such a system is capable of providing for at least 3 gal. of milk per cow per day through all the 4 or 5 summer months.
- (3) The high protein content of the herbage is available for nutritional purposes, and where cake feeding is necessary, whether with cows or with sheep, essentially carbohydrate foods are all that is required to supplement the grass.
- (4) A considerable saving in the purchase and use of concentrated food for summer milk production can be effected by a proper recognition in practice of the factors referred to above.
- (5) In a system of rotational grazing, it appears to be quite safe to allow a resting period of 5 weeks without any fear of the herbage losing its high feeding value or digestibility. It is possible that, in the instance under review, the use of nitrogenous fertilizers on the grazings enabled a longer resting period to be employed, than would have been possible otherwise; the applied nitrogen resulting in a prolongation of the period during which the herbage maintains a high protein content, and delaying the lignification which lowers digestibility.
- (6) That controlled grazing in some such form as has been described is essential to any intensive system of management if maximum efficiency and output are to be obtained.
- (7) That the intensive management of grassland, and its full application to both pastures and meadows, offers a means of farming that is particularly well suited to the small-holding.

I should like to record my thanks to the Principal of the College for granting facilities for this work to be continued, and for his generous support in all matters relating to the establishment of the holding. My thanks are also due to Mr. C. H. Harper, of the Ministry of Agriculture, for much advice and assistance. In addition to auditing the accounts of the small-holding, he has from time to time acted in an advisory

capacity on matters relating to the economic farming of the holding. Mr. R. Little, who has performed the arduous duties of the small-holder with very great skill, has been in a very large measure responsible for what success may be held to have attended the initial working of the small-holding.

* * * * *

THORN FENCES : THEIR IMPROVEMENT AND MAINTENANCE

JOHN THOMAS

It is something of a tragedy that the thorn fences of the country, generally, are in such poor condition, many of them badly neglected and some quite worn out. Hardly a field is to be found without some parts of its hedges made up with posts and rails or with wire ; while, on some estates, the thorn fences have become so derelict that, here and there, they have had to be entirely replaced by other forms of fencing.

Some big fields in the Midlands have recently been divided most of them by wire and old railway sleepers. The same type of fencing was adopted on a big estate for repairing fences some 25 years ago. Since the war, this estate has been sold, and the tenants, most of whom are now their own landlords, are having to put up with the loss and inconvenience arising from worn-out wire and rotten sleepers. Such fencing may last for years, but it is not permanent, it is most difficult to repair, and it can hardly be regarded as sightly, although there is little doubt that it provides the quickest and cheapest method of division.

There is no economy in neglecting a thorn hedge, or in making up its gaps with artificial fencing. Whenever a length of post and rail is put in to fill up a gap in a thorn hedge, another length will be required at each end in the course of two or three years. Post and rail, wire and other forms of artificial fencing are useful for a time, but, in many ways, they are not so satisfactory as good thorn hedges. Wires become slack, so that sheep and lambs force their way through ; posts and rails rot, so that cattle break them down ; and iron standards rust away and also corrode the wires they carry. Even with the periodical attention and proper up-keep which the artificial fence requires but seldom gets, its life is limited ; without such attention, its life may be short indeed. On the other hand, the thorn hedge, properly

maintained, should last indefinitely ; and for this reason, the preservation of existing thorn hedges will, in the end, prove to be the truest economy.

Apart from its permanent character and efficiency as a fence, a good hedge has the additional merit of giving shade for stock in hot weather ; and, to ensure the provision of this valuable shade, it is undesirable to cut the whole length of a hedge in one season. Stretches of a few chains length each should be left uncut at intervals. These stretches will also ensure shelter for stock in winter, although a newly-cut hedge will afford shelter much sooner than shade. A further merit, not without importance in these days of agitation about the spoliation of the countryside, is the æsthetic contribution of the thorn hedge to the rural landscape, an attribute which the artificial fence cannot hope to possess.

It may be asked why, considering their special advantages, the thorn hedges have been so badly neglected. The reason, or, rather, the chief reason, is to be found in the custom of placing on the tenant the onus of cutting and laying the thorn hedges, and, generally, of maintaining all fencing on his holding. Usually, the tenant's only concern is that a fence should last his time. Rather naturally, he does only what he is obliged to do and tries to get that done as cheaply as possible. If landlords undertook the work, they would have an eye on the future, recognizing that future growth in a thorn hedge, even though it entails periodical outlay, means a saving in the end.

Another reason for the bad state of our hedges is a technical one, and is due to the fact that, for generations past, they have, with few exceptions, been cut knee high, the result being that growth starts from that level and not from the ground. In course of time, the thorn cut in this way becomes old and stunted in growth and the roots receive insufficient nourishment. The longer the period that hedges have been cut in this manner, the more difficult it becomes to lower the old worn stovins or stools.

Reclaiming a Badly-neglected Hedge.—It is quite an art to lower neglected and worn-out hedges—those having big stumps and many gaps, in some cases showing stretches, yards long, without a thorn. Most hedge cutters will say that it cannot be done, but the writer has, personally, recovered many a thorn fence when it had nearly gone. The thorn may be smothered by elder and other quick-growing smooth wood ;

rabbits and trees may have caused many a gap ; but if a bit of thorn is left here and there, it is possible to retrieve the fence and thus avoid the expense of grubbing up, replanting young quick and protecting it with fencing on both sides.

One way of dealing with the worst cases may be termed the "root" method, and one might speak to the hedger somewhat as follows : Uncover the roots on one side of a thorn just sufficiently to examine them. Select a good healthy root ; one may strike the eye as in a good position for layering, but the root selected should be the best available and not too old. Then sever all the other roots, leaving only one attached to the thorn. From these severed roots, young shoots will spring up as if young quick had been planted. Now bring your thorn down on its remaining root, loosening the ground if necessary to get it into the right position. Care must be taken not to injure the uncut root ; never hack it unless absolutely obliged. The thorn can often be twisted on its root and brought down in quite the opposite direction to that in which it has been leaning. If the root is too big to bend, it may be split, but a young root, say an inch or two in thickness, will bend or twist in almost any direction.

Stock up all elders as you come to them. In cutting a hedge thorn, cut it close to the ground—not right off, but so that you can lay it with some part touching the soil. Take a spade and clear away any grass at the point of contact and then peg the thorn down so that it is half buried in the earth just at those bends which lend themselves for the purpose. Only an occasional layer may require pegging, as, in most cases, the thorn's own weight will suffice to keep it in position. It may help if little dents are made in the ground for the bends to rest in. The method is similar to that employed in propagating carnations, where the gardener pegs them down to strike root from a joint. Fresh roots will, in the same way, strike from the thorn, and a vigorous growth result.

To Cut a Moderately Good Hedge.—The thorn should be cut low down close to the ground, and the layer should lean slightly from the stool so as to avoid smothering the young growth. In starting to cut, one must not strike near the ground, but, when bending the thorn over to the proper angle, and splitting it away from the stool, the cut should run almost into the ground. Then trim off the other portion sticking up. The next step, and an important one, is to pare off the old stool or stump, so that, when growth begins, it

will start from the ground and not off the stump, six or eight inches above the ground. The stool should be trimmed with an upward stroke ; a handsaw is required to do this effectively in isolated cases to avoid jarring, but, if the saw is used, the stool should afterwards be finished off with a bill or with a knife. This will assist the bark to heal up, so that wet does not injure the thorn. The stool should never be left in such a jagged state as to hold water. Clear away all chips, rotten wood and leaves so that the stool is left quite clean. Proceed in this manner for the whole length of hedge to be cut.

To Stake and Bind.—To get proper stakes, every thorn suitable for the purpose should be trimmed as it is cut out. There are usually some thorns that cannot be laid in, and these are cut off. Never throw them down, however, without considering whether they will not make either stakes or binders. Stake as the work proceeds, using an iron bar for making holes and the heavy axehead to drive tight into the ground. The stakes should be sloped slightly towards the brush, and should, if possible, be threaded between the layers, thus contributing to the stiffness of the whole. Good stout stakes, driven well into the ground, should be used if a bullock fence is aimed at. If the stakes are stout enough, a nick can be cut near the bottom, and this will facilitate their being hammered in tight.

Binding can be left until the cutting is finished, or for a rimey morning, or for a day when it is too wet, perhaps, to go on cutting. When finished, the tops of the stakes should be cut off to one level.

After Care of Newly-cut Hedges.—A hedge needs special care for the three years following cutting. A good ditch, well cleaned out and filled, in a proper manner, with the waste thorns, will give considerable protection on one side for one season, but for one season only. A good back may protect the other side, but the protection is neither certain nor permanent. A strand of barbed wire on both sides will be found the most effective means for keeping stock from nibbling at the young shoots, trampling in the ditch and, generally, spoiling the work.

In their own interests, hunting men should favour the use of barbed wire for protecting a badly-neglected hedge for two or three years after cutting. The hindrance to hunting can be overcome by erecting in suitable places lengths of, say, six yards of low, boarded fencing which can be



FIG. 1. —Hedge before being cut and laid. This was badly cut and laid 11 years previously, live stakes being left and the layers not laid from the ground as seen in Figs. 2 and 3. Sheep, pigs, etc., can, consequently, get through. No young growth as seen in Fig. 6. This same hedge is seen under treatment in Figs. 2 and 3.



FIG. 2. Hedge seen in Fig. 1 being cut and laid. One layer is down, and all others are to be laid the same way.

THORN FENCES: THEIR IMPROVEMENT AND MAINTENANCE.



FIG. 3. Showing laying of hedge in Fig. 1 in progress



FIG. 4. -Hedge cut and laid in the proper



FIG. 5. A badly cut and laid hedge.

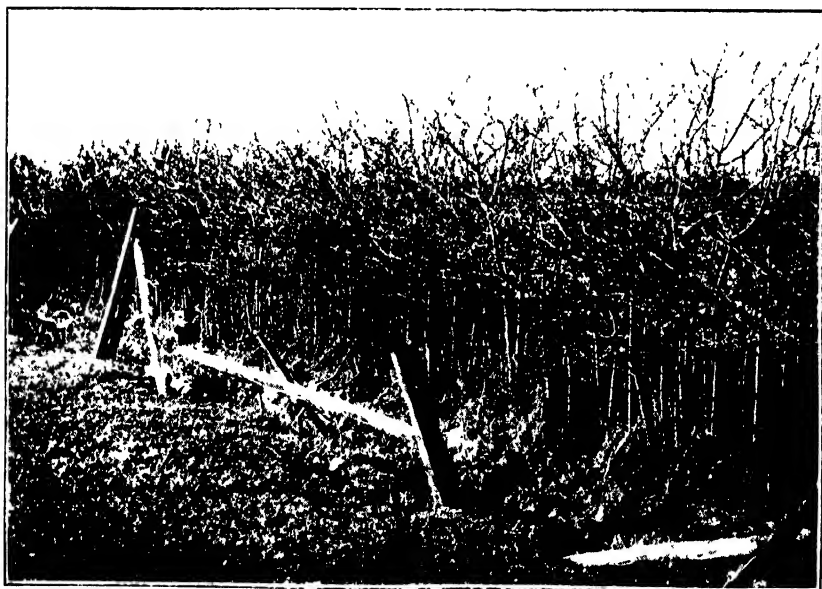


FIG. 6. Young quickset hedge of two years growth ready for cutting and laying.

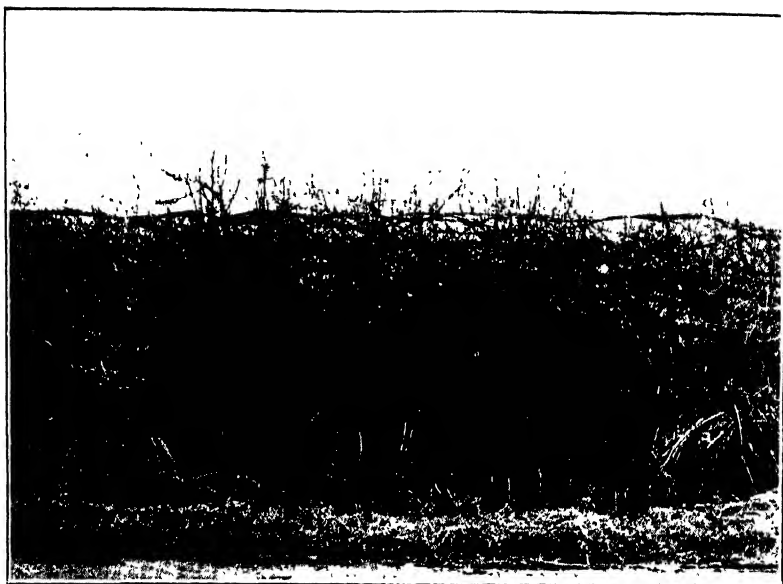


FIG. 7. Two year growth after cutting and laying in the correct way. Note all young quick from the stools at ground line.



FIG. 8. View of hedge nine years after being cut and laid correctly by Mr. Coape-Arnold. Note that there are no holes at the bottom and that it shows good sound growth from ground line.

jumped, and which is kept free from wire. This plan has been adopted by one hunting man known to the writer, but for the reason that his thorn hedges were in such bad condition that the stock could not have been kept in bounds if all the wire had been taken down.

It is a mistake to suppose that a thorn hedge when cut requires no attention until the time comes for cutting again, say, 15 or 20 years afterwards. The farmer who wishes to improve his fences must persistently follow up the work ; and a walk round hedges, some months or a year after they have been cut, will be both enlightening and instructive. He may learn much and, possibly, change some of his opinions about the best method of cutting and laying. He will often find that some nice young shoots which have shot up are being smothered by nettles, coarse grasses, elder or quick-growing smooth wood. Nothing will make hedge cutting more interesting to the farmer than recovering the young shoots from such overgrowth. Elder, as previously stated, should be stocked out when the hedges are cut ; but, after the greatest care, it will, nevertheless, be found growing among the thorns. It can, however, easily be kept in check by bruising it with a spud or even a walking stick.

Once an interest is acquired, a man becomes so keen that he will find many little jobs to do and will enjoy doing them. Hedge cutting is very much like a game of chess—you cannot make a move without thinking and deciding which thorn to sacrifice and which to lay, then how to do the work in the best manner. The brain is kept constantly at work, and there is something more than the pleasure of seeing the job well done. The anticipation of the hedge making good growth, and its subsequent fulfilment, bring their own keen satisfaction.

Expense.—A farmer whose thorn hedges are in bad condition may argue that he cannot afford to treat them in the manner described. The question of expense must be considered from several points of view ; but neglect is not economy, whether you are considering the question of manure for a crop or the cutting and protecting of a badly-managed thorn hedge. A gappy fence that lets sheep through from store land to a feeding pasture where forward cattle are grazing is not only a source of annoyance but is certain to reduce profits. Feeding cattle must have clean and well-regulated pastures, an even bite of grass that is not big and coarse, and they must not be mobbed by trespassing sheep

and store cattle. Nothing is so helpful to the grazier (and the shepherd), therefore, as really good thorn hedges, thick at the bottom.

One farmer, well known to the writer, started to cut and lay one of his hedges in the approved manner. It was near his house and only about two chains in length ; most of the work he did himself. For the first year after cutting, nettles and other rubbish were allowed to grow for protection, but, subsequently, the fence was kept clean, and a few quicks were planted to help fill up gaps. This hedge is now about the best for miles around. The effect has led to an improvement in this farmer's hedges generally, but, naturally, the expense has been cut down. He has studied economy wherever possible, but the happy medium was his motto.

Education in Hedge Cutting.—Hunts have taken great interest in hedge cutting, organizing competitions, entertaining competitors at dinner after the judging is over, and so on. This is very well in its way, but the great fault with these competitions lies in there being no one present to give instruction before, at, or after the competition, with the result that little or no general improvement results. The only gain is that hedges are made jumpable and with that the Hunts are satisfied. It is not enough, however, since future growth is hardly considered. Much more effective education than competitions afford is given at classes instituted by agricultural education authorities, if a really good instructor, who has himself been coached in effective methods, is provided to conduct them.

The Ministry desires to express its appreciation of the courtesy of Mr. C. C. H. Coape-Arnold in lending his copyright photographs for reproduction with this article.

* * * * *

PIG RECORDING IN EAST ANGLIA

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Introduction*.—Pig recording is merely another step in the industrialization of the farm and the rationalization of agriculture. Crop yields have been measured in various forms for several hundred years, but it is only latterly that milk recording, poultry laying tests, and cost accounts have been at all widely applied in measuring, not only the differences between farms and farmers' methods, but also the state of the industry. In this country, pig recording is the latest addition to a growing list of the methods of precision which place before the farmer accurate information of a type that has for many years been at the disposal of even the smallest manufacturing or distributive business.

"Pig Recording measures the pig-producing efficiency of the farmer, his pigman, and his sows. Pig Recording indicates the unprofitable sows and helps to locate the weak links in the feeding and management of a herd. By recording the number, quality and rate of maturity of each litter, it gives the farmer stubborn facts and eliminates guessing. It tells the farmer whether he has to pay for seven or ten months of a hog's time and food before he can make a bacon pig. It saves the pig's time and the farmer's money. Pig Recording pays."

This extract from a propaganda leaflet, issued by the East Anglian Pig Recording Scheme, summarizes its philosophy and immediate objects. Looking further ahead, however, it is apparent that pig recording, if properly applied, could be of considerable value in providing a rational basis for the sale of breeding stock and for establishing utility classes at live-stock shows, in the same way that production records are employed in the sale and judging of dairy cattle and utility poultry. In fact, in Sweden and Denmark, records of sows' and boars' performances have for some years been used for this purpose.

Further, another object which at first sight appears to be of subsidiary importance, but which in the end may prove to be an extremely useful phase of pig recording, is the

* For a fuller discussion of the principles on which the East Anglian Pig Recording Scheme is based and a more detailed report of the information summarized in this article, together with full references to the work, the reader is referred to:—

DAVIDSON & DUCKHAM: *First Report on the East Anglian Pig Recording Scheme*. Department of Agriculture, University of Cambridge. June, 1929. Price 1s. 2d., post free.

DUCKHAM: *Memorandum on Principles and Methods of Operation of the East Anglian Pig Recording Scheme*. Second Report. Department of Agriculture, University of Cambridge. October, 1929. Price 1s. 2d., post free.

statistical analysis of accumulated records with a view to elucidating some of the pig-keeper's many breeding, feeding and management problems. A large scale analysis of several thousand litter records should be able to solve such questions as the following :—Does the separate or "creep" feeding of suckling pigs pay? Is the best quality pig the most economical to produce? What is the maximum useful life of a sow? Which is the best strain of the most suitable breed?

Types of Pig Recording.—Various pig recording and testing organizations are at present operating in Sweden, Germany, Denmark, Scotland, Finland, Esthonia, New Zealand, The United States and elsewhere, as well as in East Anglia. As many of these schemes differ considerably in their mode of application, it is necessary to outline the principal methods employed in order to obtain an understanding of the principles on which the East Anglian Scheme is based.

Testing Stations.—The original and, at present, probably the most popular type of recording is the Testing Station, which is extensively used in Scandinavia and, to a smaller extent, in Scotland and Germany.

"In this case a limited number of selected pigs, usually four, but sometimes only two, is sent from the farm at or shortly after weaning time to a large testing piggery where the litter groups coming from herds and different sows are treated in exactly the same way and are all fed on standardized rations. After reaching bacon weight the pigs are slaughtered and all the data concerning their live weight gain, feed consumption, dressing percentage, etc., are recorded. The carcasses are then cured under standard conditions and bacon quality is also recorded. The function of the testing station, when employed by itself, is therefore confined to eliminating the influence of the nutrition factor in order to make the influence of the breeding factor directly measurable."
(*First Report.*)

These stations may be compared to existing poultry laying tests or to a system of milk recording where cows are sent to a large cow byre and fed on standardized rations, in order to measure differences in milk yield which are due to breeding alone. With pigs, their chief limitations are that they can deal with only a very small percentage of the pig population. They are also expensive. Again, although in areas of uniform farming practices, where differences between herds due to nutrition and management are small, they perform a useful function, yet in East Anglia and probably elsewhere in England, feeding varies so much that, by themselves, their usefulness is limited in that they cannot measure *on the farm* a factor—feeding—which represents 90 per cent. of the cost of pig production.

The Survey or Farm Weighing Method.—In Germany and Sweden, the litters are weighed and counted on the farm when they are 3 or 4 weeks old. By this method, which has its analogy in a milk recording system which takes count only of the production of the first few weeks of the lactation, very useful information is obtained at a low cost per pig, but the efficiency of production after weaning cannot be traced nor is it possible to measure carcass quality.

The East Anglian Scheme.—The scheme employed by the Animal Nutrition Research Institute, Cambridge, within a radius of about 45 miles of Bury St. Edmund's, is an extension of, or an improvement on, the survey method outlined above. The weight and number of pigs in each litter are ascertained when the litter is 6 weeks old, but both the subsequent rate of maturity and the carcass quality of the farmers' pigs are also obtained. The complete life history of each litter is thus obtained in the same way that milk recording in this country covers the complete lactation.

The Controlled Survey Method.—The testing station and the improved survey method are not, however, two opposing means to a common end. They are complementary and, in combination, should place the farmer in a very strong position to assess his efficiency as a pig keeper. If a testing station is used, not merely to measure differences due to breeding, but also as a check on a survey system by testing representative sample litter groups from various herds, it is possible to measure approximately the relative influences of breeding and feeding. Thus, if litter groups from one herd compare poorly with the other groups at the Station, and unfavourably with the herd average on the farm, it could be said that although the farmer's methods of feeding and management were, in fact, better than those employed at the testing station, his breeding stock was inferior to the average of the other animals tested and could be improved. (See *Second Report*.)

If, in addition to a controlled survey system, it was also feasible to collect records of the gross feed consumption on the farm, then pig recording would be providing the farmer with a service which is not at present equalled in any other branch of farm production measurement. This may be termed the "ideal" of the East Anglian Scheme, and an attempt is now being made, in co-operation with the pig testing station of the Animal Breeding Research Department, University of Edinburgh, and by means of Feed Consumption records, to explore the possibilities of the controlled survey method. It is interesting to note that the value of this

method has apparently been simultaneously realized in Great Britain, Germany and Sweden.

Pig Recording Results in East Anglia.—The East Anglian Scheme came into operation in October, 1927. By the end of March, 1929, there were 23 members, and 378 litters had been fully recorded up to weaning, whilst 1,015 pigs had been recorded at the time of marketing. It must, of course, be realized that there is a lag (in some cases of 15 months or more) between the time of farrowing and the complete disposal of a litter, which retards the rate at which records are obtained. Nevertheless, opinions expressed by farmer-members, and the fact that the membership is now over 50, go to show that the value of pig recording is gradually being appreciated in this area.

Final litter records in respect of 141 litters completely disposed of, or otherwise accounted for, were issued up to March 31, 1929, and the average, excluding 33 records rejected for various reasons, was as follows :—

No. of pigs born alive	.. ..	10.1
Do. at 8 weeks	.. ..	7.6
Average weight of pigs at 4 weeks	.. ..	13.2 lb.
Ditto ditto 8 weeks	.. ..	25.8 „
Total litter weight at 8 weeks	.. ..	196.1 „
Average weight of pigs at slaughter	.. ..	217.4 „ live weight.
Ditto ditto .. ..	.. ..	159.7 „ dead „
Ditto ditto .. ..	.. ..	132.6 „ curing „
No. of pigs recorded at slaughter	.. ..	6.1
Average loss from live to dead weight	.. ..	22.4 per cent.
Average loss from dead to curing weight	.. ..	16.9 per cent.
Average age in days at slaughter	.. ..	258.5
Average age in days required to reach 150 lb. dead weight	.. ..	250
Good quality bacon carcasses	.. ..	36 per cent.

Differences in Herd Efficiency.—It is commonly assumed that a pig should reach Wiltshire bacon weight of 200 lb. live weight and 150 lb. carcass weight when it is 200 days, or 28 weeks 4 days, old. It will be noted, however, that the “average” litter took 36 weeks to reach this weight. In fact, only one herd either consistently achieved this standard* or reached the average rate of maturity shown by Continental testing stations. This herd—the best—required 28 weeks to reach bacon weight and marketed 8.2 pigs per litter. On the other hand, the worst herd required 41 weeks to reach this weight and only marketed 4.1 pigs per litter. If it may be assumed (see *First Report*) that rate of maturity is correlated closely with economy of feed conversion (or pounds of meat produced per lb. of food consumed), then it may be estimated that

* 150 lb. dead weight at 200 days.

the difference in cost of production between these two herds was over £2 per bacon pig. This brings out in a striking way the value of pig recording in measuring efficiency of production and in enabling the farmer to compare his results with those obtained by his neighbours.

Management.—It was possible, during the period ending March 31, 1929, to collect information regarding the methods of feeding and management employed in certain herds. In the best herd, six ordinary commercial sows of various breeds were crossed with a Large White boar, and the pigs were carefully managed and fed on orthodox lines by a breeder who believed in personal attention. In spite of the low prices of bacon, and the high price of feeding stuffs, in the period covered by the *First Report* on the Scheme, he managed to make over 25s. profit per bacon pig produced. In other herds it was possible to locate points which, apart from differences due to breeding, were probably at least partially responsible for the indifferent results obtained. Thus in one herd, too much water was fed with the pig meal; in other herds there was a tendency to dilute well balanced proprietary or home-mixed meals with cheaper home-grown cereals, which probably led to protein and mineral deficiency. Another herd followed a definite policy of "storing" pigs and restricted their feed to bran, middlings, barley meal and maize. In two more herds, including the worst herd, overcrowding and its handmaid—disease—undoubtedly tended to lower their efficiency.

"Considering all herds covered by the scheme the following points may be indicated as amongst the common causes of failure to reach 'standard' weights in reasonable time: (a) Leaving large herds too much in the hands of a rather inefficient pigman; (b) Overcrowding; (c) Feeding unbalanced pig meals deficient in protein and minerals. Further, we have reason to believe that in some herds, although the rations (as planned) were potentially sound, errors in their mixing or actual feeding tended to lower their efficiency." (*First Report.*)

Quality.—There is no need to stress the importance of improving the quality of the bacon produced in this country. Quality must be improved if the British pig industry is not to lose its hold on the home market in the face of the growing competition from abroad. The assessment of quality is, therefore, an important feature of the East Anglian Scheme. Members are encouraged to market their pigs through certain "internal recording market centres" where a representative of the Scheme "grades" and "faults" the bacon carcasses, at the same time acting as an impartial farmer's representative

and observing, as far as possible, the actual weighing of the pigs.

It was found during the period under review that only two-fifths of the bacon carcasses inspected were of good quality. Sixty per cent. of these carcasses were penalized for having "too thick back fat," 45 per cent. for "uneven fat and heavy shoulders," 30 per cent. were faulted on account of "deficient length in relation to weight" and 16 per cent. on account of "thin flank and belly." All these are faults which, if present, tend to lower the sale price of the final product. The results obtained confirm the existing impressions that under half the pigs received at some Wiltshire bacon factories are suitable for producing good quality Wiltshire bacon, and that the chief carcass defects are excessive back fat, heavy shoulders, and deficient length. It must be pointed out, however, that these defects would be to a large extent obviated if the farmer could be induced, by propaganda or by the payment of a bonus on quality, to market his pigs at lower weights. For instance, it was found that with carcasses of 140-160 lb. dead weight (which is at present the Wiltshire curers' range of optimum weights), 61 per cent. were of good quality. On the other hand, with carcasses of 180-200 lb., only 10 per cent. were of suitable quality and conformation.

Two other interesting facts which have come to light, and which are confirmed by Swedish workers, are that gilts tend to make better quality bacon carcasses than hog (or castrated boar) pigs, and that certain of the bacon curers' requirements seem to be incompatible or are, at least, difficult to obtain in the same carcass. Thus, amongst the better quality pigs, gilts had thinner back fat, lighter shoulders and thicker "flank," and were not so frequently faulted on account of "deficient length in relation to weight." Again it was found that bacon carcasses which showed sufficient length, a suitable thickness of back fat, and light shoulders tended to have thin flanks and poor hams. Thick "flanks" and full hams, both of which the bacon curer requires, were, on the other hand, often associated with heavy weight carcasses with "too thick back fat," "deficient length" and "heavy shoulders."

Breeding Information.—Enough figures have not yet been collected to permit any attempt to measure breed differences, but it may be noted that Large White boars and Large Black sows were the commonest sires and dams.

"The average gestation period was 114 days and the interval between farrowing was 188 days. Rather more boars than gilts were born alive, but as the former had a higher 'infant' mortality there were fewer boars than gilts alive at 8 weeks. There was a preponderancy of first, second and third litters. Sows' litters averaged at weaning rather more in number and weight than gilts' litters. The average weight per pig in litters with small numbers of pigs at 8 weeks was not very much less than that of large litters, but the cost of production per pig in the small litters was considerably higher." (*First Report.*)

One interesting fact brought out by analyses of the figures that have been obtained, and which is referred to in the above extract from the summary of the *First Report* on the Scheme, is the comparative youth of the sow population reviewed. The sample, of course, may not have been representative, but it would appear that the tendency for "old" sows to be sold during the "slump" periods of the pig price cycle, and the fact that many farmers are under the impression that a sow is too "old" after her fourth litter, accounts for the preponderance of first, second and third litters. Canadian, Swedish and other work has, however, shown that a sow reaches her maximum efficiency with her fourth or fifth litter, and it is suggested that productive sows should remain in the herd until they have had eight or more litters.

Method of Operation and Policy.—As the result of the experience gained in the first eighteen months' working of the Scheme, by reducing the cost per litter and by simplifying the recording methods employed, it is hoped ultimately to make pig recording both financially and practically acceptable to a farmer's organization. Under the modified "1929" Scheme, which is a step in this direction, one pre-weaning weighing is substituted for the two previously recorded—each litter was weighed when 4 and 8 weeks old—and the market outlet for members' pigs is widened whilst certain simplifications have been introduced. The present "1929" scheme, which came into full operation on October 1, 1929, is outlined below.

DETAILS OF THE SCHEME.

(1) *Membership.*—Any pedigree or "commercial" pig-keeper within the area covered by the Scheme may become a member provided his entry will not derange "route" organization or finances. No charge is at present made for the services provided.

(2) *Pig Recording Diary.*—The dates of farrowing of recorded sows and other information are entered in the members' Pig Recording Diary.

(3) *Field Recorder.*—The recorder calls at minimum fortnightly or maximum monthly intervals, when (a) he extracts the relevant information from the diary; (b) he earmarks "fresh" litters; and (c) with a spring balance and a bag he weighs any litters between

4 and 8 weeks old and estimates their weights at 6 weeks (in order to measure the "maternal" capacity of the sow).

(4) *Recording Market Centres*.—Marketable pigs of all classes from recorded herds are sold through "External" or "Internal" centres. At the "Internal" centres full information regarding quality is obtained. At "External" centres, however, it is not possible to record quality, or for the weights and grades of the pigs to be "certified" by a representative of the Scheme.

(5) *Issue of Results*.—When all the pigs in a litter have been disposed of or otherwise accounted for, a Final Litter Record summarizing Prolificacy, Rate of Maturity and Quality is delivered to the breeder. This information is transferred to the member's Boar and Sow Records and a Herd Summary is issued annually.

Policy.—The policy of the Scheme is to provide a pig recording and pig intelligence service in a complete but simple and practicable form and it is hoped that this ideal will gradually be attained, but it must be admitted that there are many difficulties still to be faced. It is thought, however, that two years' experience have at least shown that pig recording in East Anglia is practicable, and that it should ultimately be possible to establish it on a permanent basis. If permanency can be achieved, there seems no serious reason to doubt that pig recording may ultimately do for the pig industry what milk recording has done for dairying.

Summary.—(1) The two chief types of pig recording are the testing station and the survey or farm weighing system. The East Anglian Pig Recording Scheme employs the latter method, but it is pointed out that, although either of these two methods by themselves provide a pig recording service of value to both pedigree and "commercial" pig-keepers, in conjunction they would provide the farmer with a fuller measure of his efficiency as a pig-keeper.

(2) The results obtained by the East Anglian Scheme between October, 1927, and March, 1929, show that wide differences exist in the pig-producing efficiency and the cost of production of the various herds; that only two-fifths of the pig carcasses handled were suitable for the production of good quality bacon, and that gilts' or lighter carcasses between 140–160 lb. (dead weight) are of better Wiltshire bacon quality than hogs' or heavier carcasses. The principal carcass faults were "too thick back fat," "heavy shoulders" and "deficient length."

(3) Experience suggested certain modifications and simplifications of the original scheme. These have been adopted in the hope of providing East Anglian farmers with a cheap and simple but complete pig recording and pig intelligence service.

THE CINEMATOGRAPH IN AGRICULTURAL EDUCATION: A LEICESTERSHIRE EXPERIMENT

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EARLY in the year 1926 the Agricultural Education Committee of the Leicestershire Education Committee arranged with the Automobile Engineering Department of Loughborough College for the construction and equipment of a Rural Crafts Demonstration Van. The van, on a 5-ton Maudslay chassis, was primarily intended for the provision of practical instruction for blacksmiths, whitesmiths, farriers, wheelwrights and other ironworking trades. It was, however, also used on several occasions for the purpose of giving instruction in cookery to children from elementary schools in rural areas—special equipment being installed for the purpose.

The possibility of cinematograph work had been foreseen, the van being equipped with a 50-volt dynamo, a 2-h.p. 50-volt motor running at 1,440 r.p.m., and 25 traction cells in cases having a capacity of 175 amp. hours at 10 hour rate. The electrical equipment was sufficient for the lighting of the van and for the provision of the necessary light and power to operate a cinematograph projector of standard size.

As the result of discussions with officers of the Ministry of Agriculture and the Empire Marketing Board, in January, 1928, the Ministry encouraged the use of the van for cinematograph work in rural districts, and the E.M.B. undertook to loan a projector and suitable films.

The display of films in daylight was considered impracticable on account of the expense of providing special apparatus. The projector eventually fitted was a "Kalee"—a standard type, manufactured by the Kershaw Projector Co., of Leeds. Minor alterations to the van were carried out at Loughborough College, and a driver-operator was engaged.

The Empire Marketing Board supplied lists of films applicable to agriculture and allied subjects, and arranged to provide most of the films free of charge. Amongst them the following were selected as most suitable for the experiment:—

Commercial Potato Growing (British).

Co-operative Marketing of Eggs (Canadian).

Aspects of Modern British Poultry Farming (British).

Soil Physics (Canadian).

The Life of a Plant.

No difficulty was experienced in obtaining other films of interest and educational value, although those which dealt

with home practice were not so readily available as films produced overseas.

Procedure.—The van commenced its itinerary in October, 1928, and visited villages in which a suitable room could be obtained. The more modern elementary schools, with their movable screens, usually provided sufficient space for seating accommodation and the fireproof cabinet which enclosed the projecting apparatus. Schools or village halls in which electric lighting had been installed were used where possible.

In spite of the fact that a "cold light" was used in the projector, the lamp being of the filament variety, the County Police Authorities required to be notified several days in advance of the display, and a permit was issued after the local police officer had reported as to the suitability of the premises. The permit required that proper gangways should be provided, exit doors readily accessible and labelled, and sand, water and blankets available for use in case of fire.

The van was drawn up outside the building and placed in a convenient position as near as possible to the room in which the films were displayed. A length of insulated cable was carried from the switchboard in the van to the projector inside the school, through the upper part of a window. The projector worked most satisfactorily, throwing a sharp flicker-free picture about 6 ft. square, at about 40-50 ft. distant. The faint "ticking" of the mechanism was not sufficiently loud to inconvenience the lecturers. Lantern slides were also utilized, these being of use on the rare occasions when the cinematograph apparatus could not be employed.

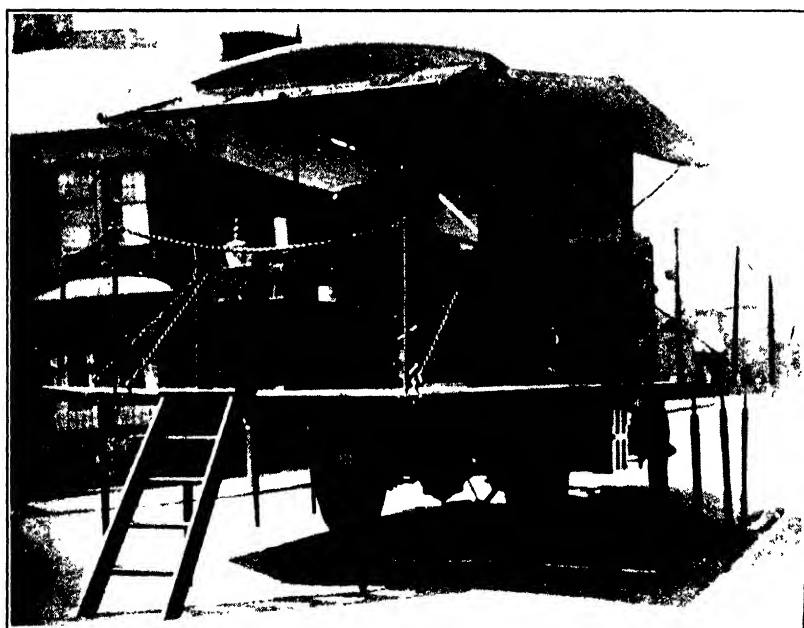
Farmers, small-holders, poultry-keepers, and others interested in land or live stock were notified by letter or small handbill of the dates and times of the lectures to be delivered. Posters were also exhibited in the district. It was usually found convenient to remain at a centre for three or four nights, thus enabling the Agricultural Organizer, the Poultry Instructor the Horticultural Instructor, or the Dairy Instructress to deliver lectures in their respective subjects.

Films Shown.—At the first centre visited, Market Bosworth, an agricultural district, the number of persons who attended on the three nights on which the lectures were given was over 400, the room being filled each night. The films shown at this centre were generally typical of those shown throughout the tour. They included the following :—

Evolution of a Grain of Wheat : Lecturer, The Agricultural Organizer.
Soil Physics : Lecturer, The Agricultural Organizer.



The Leicestershire Rural Crafts Demonstration Van, which was adapted for the purpose of the Cinematograph Lecturing Tour described in the accompanying article.



The Leicestershire Rural Crafts Demonstration Van shown open and ready for practical instruction.

Co-operative Marketing of Eggs: Lecturer, The Poultry Instructor.

The Life of a Plant: . . . Lecturer, The Horticultural Instructor.

The practice adopted throughout the tour was for the lecturer to outline the subject of the lecture and then to follow with a running commentary on the film as it was shown. After the film had ended, the lecturer proceeded with his remarks, and a period was devoted to questions.

The close interest with which the audience followed the films, and the questions asked at the close of the lecture, showed that this form of presentation of technical subjects was fully appreciated.

As the tour progressed other films were obtained, among the subjects dealt with being Bee-Keeping, Sugar Beet, Clean Milk Production and Distribution, and the Rat Menace. Films of general interest were also displayed, these usually dealing with life in the Colonies, and including such subjects as forestry, cattle, sheep, and pig farming; and experimental farms in Ontario.

A particularly good film, "The European Corn Borer," depicting the ravages of an insect pest in a maize crop, although of interest mainly as illustrating one of the difficulties experienced by American and Canadian farmers, was useful in comparing its similarity to pests found in our own country.

Films dealing with milk were in regular use. A film prepared for a firm of London milk retailers, showing the methods adopted in conveying of milk from the milking pail to the breakfast table, was greatly appreciated. This film had been admirably prepared, the captions were skilfully written and humorously illustrated by sketches. A long film loaned by the National Milk Publicity Council was also shown, and was of value in describing the care required in the production of "Certified Milk." Lantern slides supplied by the National Milk Publicity Council were also shown.

Two films prepared by the British Instructional Films, Ltd., "Commercial Potato Growing" and "Aspects of Modern British Poultry Farming," provided valuable material for the horticultural and poultry lecturers. These two films were especially useful as dealing with home practice.

The "Commercial Potato Growing" film provided an elementary survey of salient points in successful potato growing, and illustrated the common methods employed by the average farmer. It demonstrated the following processes:—

Riddling the crop for "seed"; sprouting the "seed"; examining the sprouts; opening the furrows; applying the various manures; planting "seed" and cultivating the crop: lifting and preparing the crop for market. The treatment of blight and the regulations laid down regarding wart disease were also explained.

The poultry film pictured the details of hatching, rearing, housing, and feeding, and the basis for the economic nutrition of poultry for egg and flesh production.

The Canadian film on the Marketing of Eggs was displayed on several occasions. This film described how our Canadian friends have successfully surmounted the difficulties experienced in marketing

their produce when long distances from centres of population : showed the proper methods of collecting, grading, and marketing ; and emphasized the benefits of these to both producer and consumer.

The manufacture of Vegetable Margarine was dealt with by a film entitled "From Tropics to Tea Table." This described the various processes from the growth of the coco-nut to the packing and boxing of the finished article. This film called attention to the growth in the consumption of this substitute for butter and emphasized the nutritious materials, clean handling, and efficient organization used in its manufacture.

"The Rat Menace," a film prepared for the Ministry of Agriculture, was shown during the tour and was also loaned for display at public cinemas. This film cannot fail to convince an audience of the heavy loss occasioned by the rat and the most effective methods to use in its destruction.

The film "The Life of a Plant" which was of the "slow motion" type, portrayed the complete life history of the plant. The plant described was the common Nasturtium, the lecturer being able to demonstrate its similarity to the life cycle of agricultural and horticultural plants with greater accuracy than by verbal description alone. The germination and growth was shown at a speed of 20,000 times greater than the actual rate of development. The following is a more detailed description of the film :—

"A seed falls on level ground and secures a foothold, while another from the same plant fails to penetrate the surface and dies. A seed which is washed into the soil by rain soon starts to thrust its young leaves upwards. Meanwhile, hidden beneath the ground, the primary root wriggles downwards, followed by several secondary roots. If the primary root is injured, the secondaries rapidly increase so as to compensate for the loss. The roots avoid stones and other obstacles. The root soon develops a covering of delicate hairs. These hairs extract from the soil, and convey to the root, substances required for building up the plant.

"Gases required by the plant are inhaled by the leaves, which are arranged to present the greatest possible surface to light and air. The breathing apertures, or stomata, are only visible with the aid of a microscope. These apertures have hydraulic shutters which usually open by day and close by night. Unlike most plants, the stomata of the nasturtium are on the upper leaf surface and a waterproof covering prevents them from being choked with moisture.

"The flower, when first open, is a male. Each day it raises a pair of anthers which in three hours are covered with a dust-like pollen. To obtain seed, this pollen must be carried to a female flower. To bribe insects to act as carriers, nectar is concealed at the base of the spur. The petals, brightly coloured to attract the insect, carry guides which point the way to the nectar.

"The insect, pushing between the anthers to the nectar, collects pollen on its hairs. The eight anthers ripen, and are visited by insects ; they droop and are replaced by a pistil. The flower is now female. Fresh nectar attracts insects which leave grains of pollen on the sticky pistil-tip. In a solution of sugar, we see how the grains push out their contents in the form of a slender tube. Pollen on the sugary tip of the pistil pushes out this tube to the base of the flower and so fertilizes the immature seed. The flower now curls under the leaves to avoid attracting insects from other flowers, and to protect the seed from rain. The three seeds develop. When ready for dispersal, they fall to

the ground . . . the seed covering rots away, and the life cycle starts afresh."

A film which caused marked interest was that which described the manufacture of Beet Sugar. The cultural operations in the growth of the beet were on a large scale, the whole film having been prepared in Canada. It was none the less interesting and instructive, especially to farmers who have grown this crop in recent years.

The film "Soil Physics" is an Ontario Government Film. It describes a laboratory experiment in which the permeation of water through clay is contrasted with its permeation through sand. It explains why the addition of humus improves the water-carrying powers of both the clay and the sand, and it shows how, through surface cultivation, the supply of moisture is assured where it is required, that is, at the roots of the plants.

General.—The experience gained from the experiment tends to show that there is a promising future for the cinematograph in the illustration of lectures on technical subjects. Other nations, and our own colonies, long ago realized the importance of this form of education, and it is, therefore, not surprising that the majority of the films available are made abroad.

The films of colonial agricultural life were excellent in quality, but were not in all cases suitable for comparison with the operations carried out with similar crops or stock on our own farms.

There is a shortage of suitable home-produced films relating to agriculture, horticulture and poultry-keeping, for use on a projector of standard size, *i.e.*, similar to the ordinary picture-house apparatus.

There are, of course, projectors which use a smaller film, and these may be found more convenient for display to small audiences. The range of British films for these smaller projectors is probably more extensive, as they can be produced at less expense than the more ambitious foreign film prepared for use in public cinemas.

A most satisfactory feature of the tour was the appreciation shown by the people in the villages in purely agricultural districts. The attendance at the lectures given in villages of this character was always excellent. This is possibly to be explained by the villagers having few opportunities to see cinematograph films and that they were, therefore, attracted by the novelty of the occasion. The type of audience to which the films were shown was composed, at many centres, of persons who were not used to book-learning, and it was pleasing to note their keen attention to, and interest in, this new educational method.

The tour extended from October, 1928, to February, 1929. The number of villages visited was eighteen, and films were shown on 58 nights. The time taken up each evening by the lecture and films was about $2\frac{1}{2}$ hours. There was an aggregate attendance for the full period of the tour of 4,629 persons, or an average of nearly 80 at each lecture.

Many letters of appreciation were received, amongst them being a letter from the Leicestershire and Rutland Federation of Women's Institutes. The possibility of arranging similar tours each winter is being considered. If the work is again carried on, it is probable that a smaller type of projector will be adopted, permitting the use of smaller accumulators which may be charged up more conveniently and at less expense. The picture shown by the smaller type of apparatus is quite large enough for a school-room or village hall of normal size.

The experiment was considered to be successful, and to have provided reliable evidence that the moving picture can supply a healthy mental imagery, which cannot fail to make a lasting impression. Further, the effect seems likely to be more permanent than that obtained by the ordinary methods, by which lectures are delivered without visual aid.

Similar Work in the U.S.A. and France.—It may not be out of place here to note that the United States Department of Agriculture supports an Office of Motion Pictures. This Office has produced over 200 films and distributed them widely throughout America. It favours distribution through "circuits," each having an agent who deals direct with the central office. In such circuits county agents, Department of Agriculture field men, home demonstration agents, club leaders, and other extension workers are organized, and films are sent from one to the other. The Department co-operates with State or Federal institutions in arranging these circuits, and in preparing the programmes of films which are to be sent through each area. Arrangements have also been made whereby individuals or organizations may buy prints of the Department's films at manufacturing cost. State Agricultural Colleges, extension organizations, public school systems, farmers' organizations, and boards of trade have in many cases formed their own libraries.

In France a large sum was set aside in 1923 for the use of the Ministry of Agriculture for the creation of a permanent Agricultural Cinema Commission to investigate new ways of using the cinema for the guidance of farmers. A central

bureau was formed, under the direction of this Commission, for the production and distribution of agricultural films. This bureau has, since its foundation, formed a library of 237 different films illustrating modern practices in all branches of French farm work. The films are designed for practical instruction and, unlike many of the American films, are not popular descriptions of farming for lay audiences. The library of the central bureau contains several copies of the more useful films, and, altogether, some 2,500 reels. Thirty to forty of these are sent out daily to various parts of France, and as many as 15,000 loans have been arranged in the year. This represents 60,000 presentations of instructive agricultural films before farmers in a single year. The development of the use of the cinema in agricultural France is further evidenced by the fact that 60 of the agricultural schools and colleges and 500 local centres have been fitted with cinema projectors at the expense of the bureau.

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EXPERIENCES AND IMPRESSIONS ON THE GROCERS' TOUR, JULY, 1929

DOUGLAS B. McINTOSH

[In the August issue of this JOURNAL, a brief account was given of a tour of England and Wales organized by the Ministry for a number of students taking the highest places in the final examination of the Institute of Certificated Grocers.

The impressions gained by one of them are now recorded, in his own words.]

THE grocery trade is a vital link in the marketing chain between producer and consumer. That is precisely why the Ministry of Agriculture and Fisheries (which is interested in the efficient marketing of home produce) sent a party of working grocers—mainly young ones—on a tour of representative farms and factories where home-grown food is produced or processed.

Britain has at last wakened up to the fact that she must market her goods properly. That is the deepest impression the tour left on me.

Scientific production, too, is receiving attention, and this is all-important, but we must recognize that, no matter how scientifically, hygienically and economically an article may be produced, if it is not marketed in a form and manner which appeals to the public, and in a quality on which the public can depend, it will not sell. In short, our producers must

beat the foreigner at his own game of standardization of quality and package.

To help them in this, the Ministry has originated the National Mark Scheme, which aims at offering to distributors supplies of home produce, graded, packed and marked on up-to-date lines, which will be easy to handle and attractive to the public. Thus the mark is first of all a guarantee of quality, and secondly, a guarantee of value for money.

A significant feature of the Scheme is that the National Farmers' Union are working hand in hand with the Ministry in its promotion and welfare. Up to the time of this Tour the Scheme had limited its field of operation to eggs, tomatoes, pears, apples, cucumbers and also to broccoli for export. It has since been extended to other products.

We had the opportunity of seeing the handling of eggs under the Scheme at the Wiltshire Egg Producers' packing station at Hungerford, then at the Model Egg Packing Station at Cheltenham, and finally on Messrs. Chivers' premises at Histon. The main features of the process are the strict examination of each egg under powerful electric lights, and the accurate grading methods used. Graders are of two kinds—size graders, and weight graders. The latter kind is rapidly being developed to a standard of efficiency and size of output hitherto undreamed of. Weight grading affords us the fairest and most convenient method of retailing eggs we could wish for. I was particularly impressed by the type of non-returnable container in which the eggs are packed under the Scheme. It is a fibre board case holding fifteen dozen eggs packed in "fillers" as safely as it is possible for eggs to be packed. These cases are very easy to handle and do not require the trouble of storing and returning when empty. There are also one dozen and half-dozen cartons, and these are sealed with the distinctive coloured label of the grade of eggs contained.

Very soon we shall have customers asking for "a dozen 'red-label' eggs." Is that not an ideal worth striving for, embodying, as it must, the absolute confidence of the customer that she is buying twelve eggs of a definite size and of perfect freshness; and that without even seeing the eggs!

In 1922, the British Glasshouse Produce Marketing Association, Ltd., was formed to unite producers of tomatoes and cucumbers in an effort to "push" the sale of their produce. The B.G.P.M.A. inaugurated a system of packing and grading which they claim inspired the National Mark Scheme for glasshouse produce. They now apply the National Mark,

with beneficial results. The slogan of the growers in the Lea Valley and Worthing districts—"British and Best"—is known throughout the country.

We saw the grading and packing (in non-returnable boxes) of these tomatoes at the nursery of Mr. John Cobley, Cheshunt. At the Royal Agricultural Show at Harrogate we saw the other goods to which the Mark has been applied, in addition to those which I have already described.

Though the National Mark Scheme has so far a limited sphere of activity, it is pleasing to note that various bodies of producers of other goods have also recognized the value of standardization and combined advertising.

The makers of farmhouse cheese of both the Cheddar and Cheshire types have formed themselves into organizations for the grading of their products, which are, undoubtedly, the finest cheese of their respective kinds produced in the world.

We visited Hilperton Marsh Farm, near Trowbridge in Wiltshire, and there, Mr. Greenhill, the proprietor, enthusiastically introduced us to the production and grading of cheese under the mark of the English Cheddar Cheese Makers' Federation. The mark "Cheddaration" on a cheese indicates that it is the finest quality of English cheese. Their grading system is conceived on progressive lines, and they are backing their product with well-directed publicity.

Likewise the Cheshire Cheese Federation. At the Cheshire School of Agriculture, Reascheath, we saw Cheshire cheesemaking from start to finish. We saw how science is being applied to cheesemaking, and we marvelled! The Cheshire Cheese Federation has a membership of 231, and last year they turned out 1,500 tons of graded cheese. Any cheese marked with the Federation's mark—three intertwined "C.s"—can be bought with confidence. Their system of allotting marks for grading leaves no room for defects.

The superlative quality of the finest Wiltshire bacon is unchallenged, and the same can be said of English hams. I knew that before I visited Messrs. Harris' factory at Calne and Messrs. Marsh & Baxter's factory at Brierley Hill, but I did not know how our home curers have kept pace with the times in matters of hygienic working conditions, modern apparatus and machinery, and labour and time-saving devices.

These visits left me in a welter of ideas and speculations. We have the finest breeding stock in the world, the finest pastures, and curing methods which put all others in the shade. Why do we have to import forty-two million pounds'

worth of bacon and ham per year? Surely this is a case in which the organized pig-breeders, working together with the bacon-curers, could lift our home production to hitherto undreamed of heights. Expert investigation has shown that we could use British bacon to the equivalent of another three and a-quarter million pigs per annum, which would mean raising our pig population by at least 70 per cent., for our average pig production is roughly four and a-quarter millions at present. As a grocer, I have great expectations of the effect of the National Mark on bacon and hams.

The canning industry is another in which I see great possibilities. We visited several of the best equipped and most up-to-date canning factories in the country.

The Wilts United Dairies, Ltd., has a condensed milk factory at Melksham which seemed to me a supreme triumph of organization, efficiency, hygiene and economy. That factory has to be seen to be believed.

But it is the fruit and vegetable canning business that impressed me most.

At the Cotswold Packing Co.'s factory at Ashchurch, again at the Wisbech Produce Cannery, Ltd., and finally at Messrs. Chivers' immense factory at Histon, we saw fruits and vegetables being packed by robot-like machines, under the most modern and hygienic conditions. These factories all manufacture their own cans and cases, and one of them even prints its own labels! They are packing strawberries, raspberries, gooseberries, loganberries, red currants, plums and damsons, the like of which cannot be produced elsewhere in the world. There is any amount of room for a much greater consumption of these home-produced fruits in place of some of the imported pears, peaches and apricots which hold the market at present.

Messrs. Joseph Farrow & Co., of Peterborough, demonstrated to us that we can compete with any foreigner in the matter of packed peas.

The Government is helping canners by advising on technical matters such as lacquering and suitable lacquers for the cans, colouring matters, syrup densities and utilization of waste. We saw this absolutely invaluable work being done at the Campden Research Station in Gloucestershire, where Mr. Hirst, who is adviser to the National Canning Council, wages war on undesirable bacteria.

We have the raw materials; we have the capital; we have the labour; and we have the brains. The time seems to be ripe for a big push for the sale of British canned goods. We

should do well to bring our National Mark into operation here, and we might take a leaf out of Canada's book by embossing the mark on the top of the can. It should be noted, too, that one of our foreign competitors supplies us with an excellent example of what can be done in the way of standardization of cans and syrups. These are reforms which are long overdue.

The Linco Packet Potatoes Co., of Spalding, introduced us to a new method of marketing potatoes. Size grading and packing in standard paper packages of great strength are the principles of this scheme. This new idea makes for the more cleanly and convenient handling of potatoes by both the retailer and the consumer, and deserves success.

The "champagne of England" has no foreign rivals, and, indeed, they would fare badly in comparison with the cyder which Messrs. Gaymer & Sons produce at their orchard-surrounded factory at Attleborough.

All these things we saw, and many more, but space forbids that I should continue.

I set out on the Tour with a perfectly open mind. I was willing to be convinced of the supremacy of British goods and of the great future that lies in store for them; and at the same time I was alert for the least signs of rustiness in our methods of production and marketing.

That Tour has caused at least one voice (by no means "crying in the wilderness") to lift itself in the cry of "Buy British Goods, for British is Best."

The great thing is that I can now prove that assertion to be true.

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CAULIFLOWERS AND BRUSSELS SPROUTS AS SIDE LINES ON WELSH FARMS

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IN recent years the public has taken an increasing interest in diet, and the cabbage family has come into prominence as a result of the importance attached to vitamins. The demand for these crops is likely to increase, and two of them, cauliflowers and brussels sprouts, are considered here from the point of view of production on the farm. Most of the literature on the growing of these crops is intended for the market gardener, who, it may be noted, commonly occupies more highly-rented land than the farmer, is faced with difficulty in getting farmyard manure, and has more expensive horse labour, and more insect and fungus pests. These two crops make attractive sidelines on many types of farms, and observations carried out at several farms over two years have enabled the writer to deal with the special advantages as well as the sources of loss and disappointment. The methods of growing, varieties, etc., are only briefly touched upon, since this information is given in most literature on the crops, and since they are affected by local climate, markets, etc.

Advantages of Growing these Crops on a Mixed Farm.—(1) A plentiful supply of farmyard manure is usually available, and there are few crops which give a better return for this manure than the crops in this botanical group. On farms where a large head of live stock is maintained and where the arable area is small, as on many dairy farms, these crops are an excellent means of cashing the heavy supplies of manure.

(2) These crops involve no waste where cattle or sheep are kept. Dairy cows make good use of cauliflowers which have not sufficiently firm curds for market, and also of the lower leaves of the plants; and any surplus crop forms excellent green soiling for the cows at a time of year when grass needs supplementing in order to keep up the flow of milk. From an acre of a fairly successful cauliflower crop in 1928 (receipts from sale of crop realized £68) approximately 4,300 plants were unfit for sale and were used for dairy cows. This would have been a fairly serious item where no live stock was kept.

After the brussels sprout crop has been picked (the end of January, February or March depending on earliness, etc.) the tops of the plants contain a small "heart" and a few large leaves. These, together with the top part of the stem, provide

very palatable and nutritious food for sheep or cattle at a very difficult time of the year. During the severe frost of February, 1929, these were preferred by ewes to mangolds and swedes, and practically the entire stem was eaten. Most lowland farmers in Wales keep a flying flock of mountain ewes, and the brussels sprout crop, in addition to bringing in cash at a difficult time of the year, provides green food at a critical period for the ewe flock.

(3) On an average season a good cash return per acre is obtained. In the cauliflower crop referred to above, a return of £68 per acre was obtained, most of the crop being sold to shops at 2s. 6d. per dozen. On the same farm, the brussels sprout crop, which for a number of reasons was not a heavy one, realized at the rate of £33 per acre. Most of the crop was sold at the rate of 2s. 3d. per dozen lb., there being a glut at Evesham and other market garden districts.

(4) Insect and fungoid pests do not usually become troublesome on the farms as in the case of market gardens, owing to these crops occurring less frequently in the rotation and to there being fewer walls, hedges, etc. The large white butterfly and the cabbage moths are examples of pests which are serious in many gardens and which rarely trouble these crops when grown in a small way on the farm.

(5) Land, man and horse labour can generally all be provided at a cheaper rate on the farm than on the smaller market gardens, many of which are already experiencing the difficulty of competing with farmers in growing such crops, and are turning their attention to special crops. A small area of these crops can be grown on many farms without much extra labour, and can be regarded as a means of cashing surplus labour at certain times of the year. The crops are transplanted after the sowing of the ordinary farm crops; they can be cleaned along with the root crops. The cauliflower crop does not take long to cut, about 15 minutes sufficing for selecting and cutting about four dozen heads. Brussels sprouts take longer to "pick," but picking does not usually commence until well after the corn harvest, and only a small proportion of the picking has to be carried out before the mangolds are lifted. Against the disadvantage of the time required to pick sprouts may be offset the advantage of the small bulk occupied by a given value: 1 cwt. at 3d. per lb. is worth 28s. and will go into an ordinary sack. In 1928, the first picking on the farm under observation began on October 19, and the bulk of the picking took place between the middle of December and the middle of January.

Disadvantages of Growing these Crops.—Experience shows a number of disadvantages, some of them, however, being avoidable.

(1) The most frequent source of loss and disappointment is a glut in the market. The crops are more liable to gluts than ordinary farm crops, both because they are perishable, and because a given area of land under vegetables provides food for a much larger number of people than when under crops which are converted into meat and milk before being consumed by the public. For instance, one acre of an average root crop converted into its equivalent of beef would provide about 1,800 adults with one meal, whereas one acre of cabbage would provide nearly 20 times as many people with as much green vegetable as they would require for a meal. A few extra acres of "direct crops" have a serious glutting effect in a district, and, under the present system of marketing, local gluts from time to time can scarcely be obviated. At Market Drayton in the middle of September, 1928, good heads of cauliflowers were reported as selling at 3d. per dozen, and at Kidderminster at from 6d. to 8d. per dozen.

(2) A spell of dry weather when the plants are ready for transplanting is serious, since watering cannot often be practised on the farm as it can in the garden.

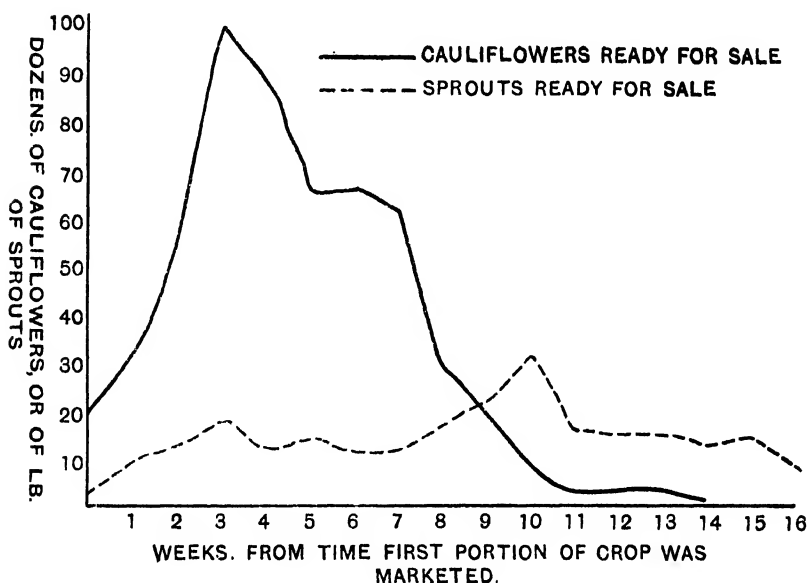
(3) Horse and hand hoeing of the crops coincide in point of time with the same work on farm root crops.

(4) When seeds are sown in the garden to avoid buying plants—which is expensive and often introduces fungoid pests—care should be taken to protect them from birds. Whole beds of these seedlings may be destroyed in a few hours, since they provide a dainty morsel for birds when just appearing out of the ground. Sowing the seeds in strips about 18 in. wide and covering with a length or wire netting of suitable mesh is a reliable and cheap remedy. After transplanting, rabbits and pigeons must be watched; two or three days' neglect may be sufficient for all the plants to be eaten.

(5) Transplanting will generally prove a failure when carried out by ordinary farm hands unless they are properly supervised. It often happens, for instance, that when swede or mangold plants are transplanted into gaps they do not live; this is because the ordinary farm worker does not realize the need of lifting the plants carefully from the seed bed, and not injuring them by rough removal. Before lifting the plants, the beds should be watered to soften the soil; the plants should then

be raised carefully with a fork and separated out from adhering soil. In dry weather "puddling" is useful when planting.

Continuity of Supplies.—Farmers not experienced in these crops might desire information as to whether, for instance, an acre of cauliflowers would be all ready for sale within a week or fortnight, or whether there might be several weeks' difference between the time the first and the last plants are ready. In an area of $1\frac{1}{2}$ acres of Brussels sprouts transplanted from June 7–21, 1928, picking commenced on October 19, 1928, and was carried on until March 1, 1929. In an area of cauliflowers ($\frac{1}{4}$ acre) transplanted from June 7–9, 1928, the crop was cut for sale from August 25 to December 8, 1928. The curves in the graph show the rates at which these crops became ready



for sale, the rates of sale being calculated on the basis of one acre. On the vertical the rate of sale is expressed in "dozens," being dozen cauliflowers, or dozen pounds of sprouts; this unit is kept for both owing to the value being approximately the same in the two cases. It will be observed that in the case of the former crop there is a much more definite peak period, and that the cutting of the crop occupied only about one-half the time of picking the latter. There was a peak period in the brussels sprout crop, but the rate of production was fairly level from the 2nd to the 15th week. A glut occurring at the peak period of a crop like cauliflowers, with a curve as in the diagram, is much

more serious than in the case of the other crop. The periods will, of course, vary greatly with season, etc. Greengrocers give preference to growers who can offer a continuity of crops. It is worthy of note that in the instances quoted above the brussels sprout crop commenced producing a regular supply as soon as the cauliflower crop dropped to 5 dozen per week. These two crops kept the retailer with a regular supply from the end of August to the middle of February.

Growth and Cultivation of the Cauliflower Crop.—A very unsatisfactory state of affairs exists with regard to varieties and strains, pure stocks being difficult to obtain owing to the plants "out-pollinating"; thus, for practical purposes a detailed study of varieties would not be as useful as in the case of cereals and potatoes. In an average season "Veitch's Autumn Giant," which produces a heavy crop of curds of good quality, is ready for market from the end of August onwards, depending on climate, date of planting, etc. If earlier crops are required, as for supplying seaside resorts, earlier varieties such as "Purity" and "All-the-Year-Round" must be used, and the seeds should be sown early in March, or better still, the previous August if cold frames or sheltered borders are available. The land should be rich for this crop, a heavy dressing of dung together with 3 cwt. of superphosphate and 3 cwt. of kainit per acre being useful before planting; a top dressing of nitrogenous manure, such as 1 cwt. per acre of sulphate of ammonia, helps to produce a heavy crop of white and tender curds. The plants should be set out in rows about 27 in. apart, and about 26-36 in. apart in the rows, and during growth the crop is cleaned like an ordinary root crop. The crop is best grown on the flat, since the plants are more liable to be dried out on the ridge. Another method is to grow them in the bottom of a ridge, and as the crop grows to break down the ridges on the stems so that they are then on the flat. The crop, however, does not require as much earthing as the brussels sprouts owing to its low leaves.

Growth and Cultivation of the Brussels Sprout Crop.— "Wroxton," "Perfection," "Harrison's XXX," and "Fillbasket" are suitable and heavy yielding varieties. Early planting is essential, not only to obtain a heavy crop but to secure better prices for the first portion of the crop. On October 19, 1928, the price per dozen lb. averaged 3s. on the coast of North Wales, and had dropped to 2s. 3d. by December 4. Planting should not be later than May; in mild districts

autumn sowings may be made so as to enable planting out to be done before the usual droughts. The soil should be well consolidated. The crop is one that does well on land which has carried late potatoes, the land not being worked except to produce the tilth in spring. Heavy dressings of farmyard manure cause the crop to produce slack buttons. A dressing of 5 cwt. of basic slag (14 per cent. phosphoric acid) and 4 cwt. of kainit per acre applied in the autumn gives good results. The plants should be set about 30-36 in. apart in rows about 30 in. apart. After cleaning the crop it is important to bring back soil on to the stems since the long stems require good support if they are to grow upright.

Thanks are due to Mr. Harry L. Jones, N.D.H., Horticultural Advisor for Flintshire, for considerable advice and information, and also Mr. W. G. Roberts, Plas Newydd, Rhuddlan, for access to costs and receipts and for so clearly pointing out the strong and weak points of these crops as farm side lines.

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POULTRY ON THE GENERAL FARM

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THE days when poultry on a general farm were looked upon as a necessary evil, or merely to be kept around the stack yards to eat up any waste grain, are rapidly passing away.

The progressive farmer now realizes that poultry are worth his serious attention, and that if they are treated with as much care and attention as would be given to any other stock, they will yield him a very satisfactory profit.

If poultry are to be kept to any extent on a farm it is essential that they should be attended to by someone who has a sound knowledge of the subject and is prepared to carry out the many small details which are necessary to ensure success. No farmer would dream of keeping a herd of milking cows or a flock of sheep without employing a cowman or a shepherd—but how seldom it is considered necessary to employ a poultry man or woman. Poultry keeping is a skilled branch of agriculture, and as such calls for skilled management. Good poultry men or women are scarce, but with a growing demand for them and with the facilities now available at Agricultural Colleges, Farm Institutes and other places, for gaining knowledge of this work, this shortage should soon be overcome.

The extent to which labour will be necessary will depend largely on the system or method adopted and the extent of the operations. If only a few poultry are kept, their care might be combined with some other department, but it cannot be too strongly emphasized that sound knowledge of the subject is essential, and particularly is this so when hatching and rearing operations are carried out.

The general farmer with plenty of land available has undoubted advantages over the poultry farmer, but one of the problems which confront him is how to use that land to its best advantage.

Systems.—Before deciding to put poultry on the farm on a sound basis, it is well to consider the various systems under which they may be kept, and perhaps one of the most difficult matters to decide is the method to be adopted.

It is not possible to lay down any one definite system as suitable to all conditions: each farm must be considered on its own merits. It may be that there is some land, which has been regarded as waste land, which could profitably be used for poultry. On the other hand, poultry may be run on pasture land, where they will do a considerable amount of good, and if kept in reasonable numbers need not displace a single head of larger stock. This is a statement which is often doubted by anyone who has not tried to work in poultry in conjunction with other stock on the farm, but the manure deposited by the birds will encourage extra growth which will more than compensate for the area taken up by the poultry house and land immediately surrounding it. ♣

Some farmers may prefer to set aside a certain area of land which is devoted entirely to poultry and not used by any other stock whilst the poultry are on it. This means in practice the laying out of a poultry farm with fixed houses and the erection of a considerable amount of fencing, posts and high wire netting. It has the advantage that labour in attending to the birds is reduced, but many other advantages are lost. If at any time it is desired to move the plant to another part of the farm, and if large houses have been erected, considerable time and labour are involved, while it will probably be found that grass has grown into the wire netting, making it difficult to move—and pieces may be broken off and left lying about the ground to the danger of the other stock.

It is quite possible that it may be found desirable to have a few permanent pens near the farm buildings which can be

used at certain seasons of the year for breeding stock or for fattening surplus cockerels. When setting out these pens they should be so arranged that the wire netting and posts between each pen can be readily removed when the pens are unoccupied, as it is then much easier to graze or cut the grass. Nothing will help to keep the grass in good condition and prevent the coarse growth with tussocks and holes so often seen on poultry farms, as grazing by other stock.

When free range is available, as it is on a general farm, then it is well to make full use of it, even though this may involve a considerable amount of walking in attending to the stock.

Food and Water.—Arrangements should be made to have corn bins in or adjoining the houses, in which a week's supply of grain and dry mash can be stored. A dust-bin should also be placed outside each house to receive the manure from the droppings boards each time these are cleaned. It will then be possible to distribute a supply of food weekly by cart and collect the manure.

Water is quite a problem, for fowls in full lay will drink a surprising amount, especially when dry mash feeding is adopted. Every house should be provided with guttering leading to a tank, on the north side of the house, to collect rain water. In a normal season this supply should prove sufficient, except perhaps during the height of summer, when it will be necessary to cart and distribute water if the tanks run dry. Special appliances on the "ball cock" principle can be obtained to ensure a constant supply to the birds. The birds should never be without water, and in frosty weather special care must be taken, for an inadequate supply of water will soon cause a drop in the egg yield.

Housing.—Housing is worth a great deal more attention than it is generally given on a farm. The houses should be dry, with good ventilation but free from draughts. Each should be provided with a good, dry, well-lighted floor, well covered with straw (wheat straw for preference), in which the corn can be scattered. Care must be taken to keep this litter as dry as possible, and some little difficulty will be experienced during damp weather if the ventilation is not good or the floor is unsuitable. Even with good ventilation and a good floor, it is sometimes very difficult to keep the litter dry, and should it become wet, steps should be taken to renew it as soon as possible, or the health of the birds may be seriously affected.

In recent years great improvements have been made in the design of poultry houses, and in whatever type is adopted, provision should be made, by means of movable shutters or windows, to allow direct sunlight to enter the house and reach the birds. Sunlight is one of the few things of great value that can be obtained free of cost, and full use should be made of it.

It has been found quite possible to rear and keep birds in good health and production entirely confined to houses, provided that direct sunlight can reach them. It is not suggested that this method should be employed on a general farm, but it is mentioned to show the great value of sunlight.

With weather such as was experienced last winter, the value of good housing was very forcibly brought home, and those who had good houses and were able to confine their birds in them, found that their egg supply kept up to normal.

Size of Flock.—For laying stock a convenient unit or size of flock in which to run the birds is 100, and it is much better to have five or ten 100-unit houses distributed over a large area, than to have one flock of 500 or 1,000 birds. If the houses are placed sufficiently far apart, say 100 yards, then it will be found that the birds will keep to their own houses. Houses placed in a pasture field in this manner should be protected by a fence or a strand or two of barbed wire round each house to prevent damage to the houses by larger stock. Apart from this no wire netting will be required.

Replenishing Stock.—It has been shown that there are various methods under which adult stock may be kept. It is rarely advisable, unless a bird is of exceptional value as a breeder, to keep laying stock for more than two seasons, and those which prove indifferent layers are better disposed of earlier than this, and their replacement has to be considered.

As with adult so with replacements there are several methods which can be adopted. Hatching and rearing can be eliminated altogether by the purchase of six-months-old pullets, or partly so by obtaining three-months-old pullets, which in many ways is a most suitable method for the farmer. By this method, all the work of hatching and rearing up to that age is cut out and the pullets are delivered at a time when the hay harvest is over and they can be put into colony houses on the pastures and so matured under ideal conditions. With this system no breeding stock or male birds need be kept, nor are any incubation or rearing appliances required.

Another system is to purchase day-old pullets of a sex-linked cross, whereby the sex can be distinguished at the time of hatching. Here again the keeping of breeding stock is unnecessary, and the rearing of surplus cockerels is eliminated. At first the cost of these methods appears high, but when all the items connected with the keeping of breeding stock—running incubators, rearing, etc.—together with the need for expert attention in these matters, are considered, it is questionable whether it is not better for the general farmer to leave this to the specialist breeder and purchase three- or six-months-old pullets.

It has often been said—and there is much truth in the statement—that the crux of the question of profit from poultry is successful hatching and rearing, and this again is dependent on having good breeding stock which have been properly managed. Should it be decided to carry the work right through, then the question of breeding stock and hatching and rearing appliances and methods of carrying out this work, must be considered.

Breeding and Rearing.—The breeding stock should be composed of the best hens selected from amongst the pullets at the end of their first laying season, and should be mated to one-year-old cockerels bred from specially selected hens. If the stock on the farm is not trap-nested then it will be advisable to purchase the male birds from a specialist breeder, and it is possible to select good stock by a study of the results of breeders' birds entered in egg-laying trials. It will not be necessary to go far afield, as in many counties laying trials are now conducted by the County Authorities and a report of the results can be obtained, giving the names and addresses of the breeders, and those who breed the variety it is desired to keep can be visited, stock inspected and the necessary purchase made.

The choice of breed is not so important as the strain: once the actual breed or first cross to be kept has been settled, a really good strain of birds should be ensured.

If winter eggs are required it is essential that chickens should be hatched at the right time of the year, and to this end incubators, of which there are many reliable makes, are generally relied upon, broody hens often being scarce in the early months of the year. If a suitable outbuilding is not available, then a special incubator house must be put up, the aim being to have a building which can be kept at an equable

temperature of about 50° to 60° F. during all weather conditions.

Rearing appliances of many different types can be obtained, from large brooder houses taking many hundreds of chicks, down to foster mothers for 50 or less.

The large brooder house does its work well and has many advantages, especially in bad weather: it also has its disadvantages in that it is not portable. Within the last few years, however, experiments have been carried out with the intensive method of rearing chickens, *i.e.* without any outside run, up to the age of about eight weeks, and very satisfactory results have been obtained. If this method is adopted it is essential that the correct type of housing should be employed, provision being made, by means of suitable movable windows or drop shutters, for direct sunlight, *i.e.* sunlight which does not have to pass through ordinary glass, to reach the chickens. The large brooder house is very useful with this method, especially during the early months of the year.

Another satisfactory method on a farm is the colony system: portable houses can be erected to take up to 250 chickens, so enabling the farmer to take full advantage of fresh land, the houses being moved after each batch of chickens has been reared in them. Shelter is very necessary for young stock, and this can often be obtained by placing the houses near banks or hedges, but if this is not possible artificial protection should be given by means of thatched hurdles or sheets of corrugated iron.

Under this system it is advisable to fence off from other stock, a fresh area of land each year for this purpose, and never to run young chickens two years in succession on the same piece of land.

When the chickens are able to do without artificial heat, they may be kept on in the rearing houses if these are large enough, or be transferred to other houses. A very good type of house for this purpose is the Sussex Night Ark, which is particularly useful on a farm, as the floor consists of wooden slats raised off the ground, through which the manure falls direct on to the land and cleaning out is not necessary, it being merely necessary to move the house a few yards every day or so. As soon as the sexes can be distinguished, the cockerels should be removed, those not required for stock being specially fed and disposed of as table birds.

Plenty of free range should be allowed for young growing pullets, which may be kept on in the colony houses until the time arrives for them to be transferred to their permanent laying quarters. This move should not be delayed too late in the season, as it is desirable to get them well settled down in their laying quarters before the end of the summer if a plentiful supply of eggs is to be obtained from them in the autumn. Once settled down, they should not be moved again until the winter is over, or a serious drop in yield may be experienced at the time when eggs are realizing the most remunerative prices.

There is no doubt that the general farmer has very many advantages. Much of the food required can be grown on the farm and his grain will yield a higher profit if converted into eggs and poultry. Skim milk will probably be available, and it is of the utmost value for chicken rearing and can also, with advantage, be given to laying stock. Straw is available for litter, and when it has served its purpose in the scratching sheds, it should be mixed with the poultry manure, which is by no means a waste product, but a most valuable by-product of the poultry to the general farmer. To get the best value from poultry manure, however, it must be properly treated. In order that the nitrogen, in which it is very rich, may not be lost, poultry manure should be stored under cover. It should therefore be removed from the bins to a dry shed, and if such an out-building is not available it would pay to provide a special shed. The manure should be mixed with dry soil in the proportion of 2 to 1 of dry earth, and be frequently turned over. It will then be possible to get it into a consistency which is easily workable. To it may then be added superphosphate at the rate of about one-fifth of the weight, or kainit or potash salts one-tenth of the weight of the soil-dried manure. This mixture can then be used with an ordinary manure drill and great saving can be effected. It has been estimated that 500 birds will produce about $\frac{1}{2}$ cwt. of manure per night whilst roosting, and this is easily collected from the droppings boards.

These few notes merely outline briefly some of the questions which confront the farmer, but full use should be made of the services of the County Poultry Instructor, who will always be willing to pay a visit, free of cost, to the actual farm, and give advice on the spot as to the best methods to be employed in each individual case.

* * * * *

WORLD POULTRY CONGRESS, 1930.

THE Government's invitation to participate in this Congress has now been accepted by over 40 nations, of which 27 have established National Committees for the purpose of organizing their representation. Reports received from the Congress Director, Mr. Percy Francis, O.B.E., who recently visited European countries on behalf of the Congress, accompanied by Mr. Elford, First Vice-President, and the United States representative, indicate that the most active interest is being taken in the Congress, which will exceed in size and effectiveness any previous Exhibition of a similar character. The movement in favour of the development of poultry as an industry is clearly not confined to Great Britain. Similar efforts are being made in countries abroad, and the British industry is alive to the importance of having a stake in this big international movement.

Outside Exhibits.—In addition to the display of livestock in the main Crystal Palace buildings, facilities will be afforded for putting flocks of birds in a prominent position in the grounds, and a moderate scale of fees has been adopted which should result in a very strong outside section. The displays will be grouped in three categories. Flocks of 12 birds (which may, if more convenient, be made up of two small breeding pens) can be entered for a fee of £10; flocks of 25 birds for a fee of £15; and flocks of 50 birds for a fee of £20. The poultry breeder desiring to show birds in this section will make his own arrangements for housing, and no extra charge to appliance makers for showing these will be made. Already certain appliance manufacturers are considering the provision of houses in this section, and particulars will be furnished to poultry breeders on application. It should be added that the poultry breeder may, if he so desires, look after the care and feeding of his birds during the Exhibition, or alternatively this responsibility will be assumed by the Committee by mutual agreement.

The Work of Voluntary Organizations.—Free space is being allotted to voluntary organizations who wish to be represented in tangible form at the Congress, and leading societies, such as the Poultry Club, the Scientific Poultry Breeders' Association, the National Utility Poultry Society, and the British Fur Rabbit Society, are already making provision for the staging of exhibits illustrating their work. Some of the work, which

is of a very definitely educational character and of direct importance in developing the industry, may find a place in the national exhibit which will be staged for the United Kingdom. The Fur Board, Limited, for example, have come forward with an offer to supply a valuable range of garments made from home produced fur, and in all probability this will make an attractive item in the national exhibit.

Horticultural Displays.—In order to add to the effectiveness of the Exhibition as a whole, the Ministry has invited the co-operation of certain leading horticulturists, who will become responsible for massed displays of flowers and plants throughout the Exhibition. Leading firms realize that the Congress will provide an opportunity of showing to a large assembly of visitors from all parts of the world, as well as a substantial section of the home public, the standard of perfection which has been reached by British horticulture.

Trade Section.—The Congress Committee has made a further appeal to commercial interests in Great Britain to make sure of space in this section. Demands from foreign firms have been heavy, and it is very important that British commercial interests should be adequately represented, in order that home manufacturers may be brought to the notice of the public. Very little space remains to be sold, and application should be made without delay. All communications should be addressed to the Congress Secretary, 10 Whitehall Place, London, S.W. 1.

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NOVEMBER ON THE FARM

J. R. BOND, M.Sc., M.B.E., N.D.A. (Hons.),

Agricultural Organizer for Derbyshire.

Weather Notes.—The farmer would at any time be interested in a reliable forecast of the weather weeks and months ahead; but in the immediate future he would particularly like to know what will be the general run of temperatures from January until April or May. If he could know that these months would have severe and backward weather, he would tighten still further his restrictions on the use of fodder during the old year and would reduce his stock by marketing such as were saleable. A certainty of mild conditions, however, while not permitting of laxity in fodder economy, would encourage him to adopt such measures as top dressing his "seeds" or permanent grass for an early

bite, and even sowing rye and Italian rye-grass in November to provide spring grazing.

Many people nurse the theory that a hot summer must be followed by a hard winter. By the same reasoning a dry summer would entail a wet winter, which is, however, more commonly associated with mild conditions. Lord Bacon (1561-1626) wrote that a hot and dry summer, especially if the heat and drought extends far into September, portends cold weather in the latter part of winter and the beginning of spring. An examination of the temperature records of November to May after the six dry summers mentioned in October notes, shows that in five out of the six years, the following March temperature was above normal and in only one of the six years (1922) was April appreciably cooler than the normal for the month. One has to go back to 1887-8 for a good example in support of Bacon's observation.

Cattle Ponds.—After criticizing open ponds subject to pollution as often harbouring disease germs (*vide* this JOURNAL, July, 1928) one hesitates to discuss their use and construction. The question has been raised by a correspondent, however, and doubtless many other farmers, who have recently had difficulty in providing water of any kind for their cattle, have wondered as to the possibility of using "dew ponds" in their district.

The term "dew pond" is rather misleading, as it is very doubtful whether dew contributes materially to the supply of water furnished by such waterings as the "meres" of the Derbyshire limestone hills. Dew represents the condensation of moisture rising from warm earth as it comes in contact with a colder atmosphere. Possibly mist and fog, which are frequent phenomena in upland districts, contribute something to the water content of ponds; it is said that the "dew ponds" of our Southern Counties are fed by sea fogs, which are presumably warmer than the water in the ponds on the hills. Derbyshire hill farmers, however, do not regard their meres as fed by dew or mist but only by surface water. These pools are almost invariably situated in a position where they can receive water running off the surface of higher grass land; they fill up in wet weather and tend to fail in prolonged drought.

A typical Derbyshire mere is circular, about ten yards in diameter and slopes gradually to the centre, where it is four or five feet in depth. Such a pond when full holds about

10,000 gallons of water, which would supply 8 gallons per day to 20 cattle for eight or nine weeks. In constructing such ponds, which is autumn work, the bottom of the requisite excavation is first covered with a layer of quicklime about three inches thick; this is spread uniformly and slightly watered to make it adhere. Over this are spread, trampled and beaten down, two layers of clay, each three or four inches thick. The whole is then gone over several times by the beaters and sprinkled each time with water, and care is taken to prevent the formation of cracks. The last process is to cover the clay with a thick protective layer of stones or to pave such part of the clay-covered surface as is likely to be reached by the hoofs of the cattle; a suitable fence may be erected to protect the unpaved part of the mere. Similar procedure to the above was adopted about 150 years ago when making the ponds found in the North and East Ridings of Yorkshire. To-day concrete is coming into service for the purpose of pond-making, but care has to be exercised to avoid cracking during construction.

If the writer's view is correct that meres are simply collecting and storing ponds, not fed mysteriously by dew or mist, they may be expected to function in any district, if made water-tight and if situated where they can collect some run-off water as well as rain falling directly into them. A "mere" ten yards in diameter itself receives over 900 gallons of water in a month of $2\frac{1}{2}$ -inch rainfall; and during winter, when the rate of evaporation is slow, a considerable supply might be collected in this way alone. Obviously little additional catchment area would be required to obtain a full pond by the end of an average winter.

November Operations.—The principal field work in this month is the completion of stubble ploughing and wheat sowing. Stubbles intended for roots in 1930 should be turned over rather deeply, this being the proper place in the rotation for the soil to be deeply inverted. On heavy land in moist situations the rectangular unbroken furrow turned by the long breast is preferable to the flat, broken work of the digger at this season; the latter class of work commonly entails the formation of a muddy surface which holds the moisture instead of allowing it to percolate freely, and this again may delay the drying of the soil in spring for further cultivations.

Shallow ploughing and shallow drilling should be the rule when preparing for and sowing wheat after mangolds and

potatoes. Experiments have proved that it is better to plough than to drill wheat on an unploughed potato tilth, probably because the fineness of the surface following the use of the potato digger leads to the formation of a winter cap; wheat winters best when there are sufficient small clods on the surface to facilitate drainage and to protect the seedlings against wind and frost. Deep drilling in November delays germination and does not prevent injury by freezing.

Maiden seeds come through the winter better if grazed down moderately rather than left rough; but severe eating back late in the month is injurious, especially if stock happen to be in the field when frost occurs. If they are required, ground lime or phosphates may with advantage be applied to young seeds at this time of the year. Grassy leys that are intended to be forced with nitrogenous dressings, to produce an early bite, should now receive an application of yard manure, or if this is not available, about 5 cwt. of a mixture of phosphates and potash.

To save fodder, cows will probably be allowed to continue going out in the daytime as long as the state of the gateways, passages and the turf will permit. The Harper Adams experiments of some 20 years ago demonstrated the possibility of extending the outdoors period appreciably. The limit to the duration of the period when the cows are out by day and in by night may, however, be fixed by the difficulty of keeping the udders clean enough to avoid taints in the milk when rain has softened the ground under foot. To promote the growth of the winter coat, which permits of the proper ventilation of the shed later in the winter, the sheds should be kept cool at night at this season.

With the gradual substitution of roots and long fodder for grass in the daily ration of the herd, the nature of the concentrates used should be correspondingly altered to supply more protein, until the typical "balanced mixture" is arrived at. In cases where more than 40-50 lb. of roots are fed per head per day, however, the starchy part of the mixture of cakes and meals may be reduced, reckoning each 10 lb. of excess roots as equivalent to 1 lb. of starchy meal.

NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,
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Manuring and Quality.—In recent years attention has turned to the quality of pasture grass in relation to its content of mineral matter.* It has been shown that there is a close connexion between the amount of available ash constituents in the herbage and the growth, fertility, and general well-being of the grazing stock. Good productive grassland usually contains a higher percentage of minerals than second-rate pasture, which in its turn is richer in ash constituents than those poor grazings found in some parts of Britain, and in extensive areas abroad, in which the stock suffer to a greater or less extent from a series of diseases now known to be the result of mineral deficiency. If the shortage is less acute, unthriftiness rather than actual disease may be the result. The ash constituents most often present in insufficient amounts to meet the need of grazing animals are lime and phosphoric acid.

It might be expected that the richness or otherwise of the soil in the elements of plant food would be reflected in the composition of the plants themselves. This has been shown to be the case. Further, the artificial enrichment of the soil in available plant food, by the use of fertilizers, also affects the amount and composition of the ash of the growing crop. Thus Lawes and Gilbert determined the composition of the hay from the permanent grass plots at Rothamsted over a period of eighteen seasons. The following table is calculated from some of their data :—

ROTHAMSTED: PARK GRASS PLOTS, 1856-73.

Yearly Manuring	Composition of Hay. Per cent. of dry matter.				Removed from soil lb. per acre.			
	Nitro- gen.	Lime	Phos. Acid	Potash	Nitro- gen.	Lime	Phos. Acid	Potash
No Manure ..	1.66	1.22	0.37	1.34	34	24.9	7.6	27.6
Superphosphate Complete ..	1.58	1.17	0.65	1.32	35	25.0	13.0	28.9
Minerals (1) ..	1.74	0.96	0.64	2.78	58	31.7	21.1	92.1
Sulphate of Ammonia ..	2.16	0.85	0.38	1.07	55	21.7	9.9	27.4
Sul. Amm. + Minerals ..	1.55	0.60	0.58	2.58	74	28.8	27.7	124.0

(1) Superphosphate and sulphates of potash, soda and magnesia.

* See J. B. Orr, *Minerals in Pastures*, Lewis & Co., London, 1929.
See also J. B. Orr, *Trans. High. Agric. Soc.*, 1929.

The relationship between the manures and the composition of the ash is well shown. Superphosphate almost doubles the percentage of phosphoric acid in the ash. The addition of potash to the phosphate likewise doubles the amount of potash in the ash. Sulphate of ammonia increases the nitrogen in the hay and so forth. The Rothamsted plots exemplify extreme conditions and cumulative effects. Similar results, however, are on record from many other sources. The most striking changes in the composition of the ash of grass brought about by fertilizers occur on very poor soils or on soils exceedingly deficient in some particular constituent. Thus Godden at the Rowett Institute found the following effects on a poor and a fertile soil respectively :—

<i>Manuring</i>	<i>Very poor Moorland Soil.</i>		<i>Cultivated Soil</i>	
	<i>Lime %</i>	<i>Phosphoric acid %</i>	<i>Lime %</i>	<i>Phosphoric acid %</i>
No Manure	0.59	0.29	1.16	0.96
Lime.. ..	0.77	0.30	1.37	0.92
Superphosphate ..	0.94	0.71	1.16	0.93
Lime and Super-phosphate ..	0.98	0.73	1.56	0.92

The use of mineral fertilizers on pastures operates in two directions to increase the mineral content of the herbage. The plants themselves are enriched in ash constituent and the balance of species is shifted in favour of those which can best utilize the added nutrients. Thus legumes follow the application of phosphates, lime, and sometimes potash; and they are on the whole richer than the grasses in mineral matter, particularly in lime, when grown under similar conditions. In addition to considerations of mineral content there is the improvement in quality due to the higher nitrogen content of the leguminous plants. There is also an increase in yield in most cases, which is doubly valuable in conjunction with the better quality.

Rock Phosphate for Pastures.—An increasing amount of ground mineral phosphate is being used on grassland, and there are several reasons why this type of phosphate should be given its first trial on the pastures rather than for arable purposes. Grass is a perennial crop with a long period of growth and is therefore suitably manured with a fertilizer which does not as a rule show its full effect in the year of

application, but comes into action in the second and subsequent years. A good supply of moisture in the soil is a favourable factor for the solution of difficult soluble manures, and usually grassland is associated with either retentive soils or high rainfall areas or both. Moreover it is believed that a slight lime deficiency helps the availability of insoluble phosphates, and here again is a circumstance frequently met with in grassland. The good supply of organic matter and high evolution of carbon dioxide associated with the thick turf is also helpful. A dressing of about 5 cwt. per acre of finely-ground rock phosphate, 80 per cent. passing through 120 meshes or 90 per cent. through the present standard basic slag sieve, is well worth a trial on grass which is known to give a good response to phosphatic manuring.

The Application of Slag.—Basic slag is the most widely used phosphate manure for grassland improvement. Dressings providing about 100 lb. of phosphoric acid per acre are usually given, this being equivalent to 8 cwt. of 11 per cent. slag or 6 cwt. of 15 per cent. material. A few notes on the application of basic slag to grassland may be in place at this season.

The land should be prepared to take the manure. It is an advantage to have the grass stocked down close, following this by tearing out the coarse patches and opening up the surface mat with the harrows. This gives the manure access to the soil and also makes room for the development of the finer herbage encouraged by the slag. The distribution should be as even as possible. A little attention to the working parts of the manure drill and care in its regulation should secure this, and the manure goes on better if a calm day is chosen for the work. Distribution is simpler when fairly large quantities of manure have to be applied per acre. This is the case when a low grade slag is used; but other considerations such as transport may outweigh any advantage on this ground. Basic slag tends to set into a cement-like film when broadcast on moist herbage, so it is advisable to apply the manure when the grass is dry so that most of the dressing finds its way to the soil.

The question of supplementary manures sometimes arises, although generally speaking slag alone gives good results. Lime is rarely necessary except on very acid soils. Potash has proved valuable in certain cases, usually on the lighter land, and where this is so the slag and potash salts may be applied together; the mixture being made shortly before sowing.

Nitrate of Potash.—Although not as yet a well-known fertilizer salt, potassium nitrate has found its way into British practice in connexion with certain specialized crops. It is used in the Evesham area for fruit and market garden crops, and in Hereford, Worcester, Kent and Sussex for hops. A certain amount is also applied as a top dressing for sugar beet. The combination of quickly available nitrogen and

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended October 9.				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	9 11d	9 11d	9 11d	9 11d	12 4
Nitro-chalk (N. 15½%) ..	9 19d	9 19d	9 19d	9 19d	12 10
Sulphate of ammonia:—					
Neutral (N. 20·6%) ..	9 11d	9 11d	9 11d	9 11d	9 3
Calcium cyanamide (N. 20·6%)	8 14s	8 14s	8 14s	8 14s	8 5
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%) ..	..	10 10h	..	..	..
Kainit (Pot. 14%) ..	3 4	2 17	2 17	3 0	4 3
Potash salts (Pot. 30%) ..	5 0	4 15	4 17	4 14	3 2
" (Pot. 20%) ..	3 13	3 7	3 6	3 8	3 5
Muriate of potash (Pot. 50%)	9 10	8 16	8 16	8 19	3 7
Sulphate,, " (Pot. 48%)	11 11	10 18	10 17	10 16	4 5
Basic Slag (P.A. 15½%)||	2 13c	2 3c	..	2 9c	3 1
" (P.A. 14%)||	2 7c	1 16c	1 16c	2 3c	3 2
" (P.A. 11%)||	..	1 9c	1 9c	..	..
Ground rock phosphate(P.A.28·27½%)	2 10||	2 7||	..	2 5a	1 8
Superphosphate(S.P.A.16%) ..	3 11	..	3 6	3 6	4 2
" (S.P.A.13½%)..	3 5	2 16	3 0	3 0	4 4
Bone meal(N.3½%,P.A.20½%)	8 15	8 10	8 12	8 0	..
Steamed bone flour (N. ½%, P.A. 27½-29½%) ..	5 17b	..	6 10	5 2	..

Abbreviations: N.—Nitrogen; P.A.—Phosphoric Acid; S.P.A.—Soluble Phosphoric Acid; Pot.—Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 80% through standard sieve. a. 85% through standard sieve.

§ Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 6s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f F.o.r. Gote.

potash is said to give a better quality and finish to the above quality crops than nitrate alone.

Potassium nitrate was one of the earliest inorganic salts whose fertilizing action was discovered, but its use for this purpose was completely overshadowed by the demand for nitre as a constituent of gunpowder. It was made in nitre beds, the nitrifying organisms converting the nitrogen compounds of the organic material composing the bed into nitrate. This process is still carried out on an extensive scale in India and other tropical countries. Potassium nitrate also occurs in Chile saltpetre, and a certain amount is derived from this source mixed with varying quantities of nitrate of soda. In recent years it has been made by the interaction of nitrate of soda with muriate of potash, or nitrate of lime with sulphate of potash. The fact that a further manufacturing process is involved, on substances which are already fertilizer salts, tends to increase the unit value of potash and nitrogen in the compound slightly above those values in the original constituents.

High grade potassium nitrate contains about 40 per cent. of potash (K_2O) and 14 per cent. of nitrogen. It is therefore highly concentrated. It also picks up considerably less moisture from the air than the nitrates of soda, lime and ammonia. Potassium nitrate is a constituent of certain of the high grade compound fertilizers now being made in Germany, where experiments have shown it to be at least the equal of the equivalent mixture of sulphate of potash and nitrate of soda, and possibly superior in the case of sugar beet.

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NOTES ON FEEDING STUFFS

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Variety in the Ration.—One attribute of a first-class ration which is usually stressed in writings on animal feeding is that it contains a large variety of feeding stuffs, derived from a number of different plants. It is worth while to consider certain aspects of this question.

We realize at the outset that comparatively few foods are balanced, as regards the amount of protein they include, for any class of stock, and the same holds good in respect of minerals. It follows that two or three foods, at least, will be necessary to make up a ration conforming at all closely to the

scientific requirements. The usual advice proffered, however, is that the number of different foods used, particularly with cows, should be seven or eight—in fact the more the better. With high producing animals the greatest difficulty often is to get them to eat enough nutrients to support the highest performances of which they are genetically capable, and in such cases the most reasonable way of tempting their appetites is to offer them a good variety of foods. It may well be claimed that, in general, variety adds to the palatability of a ration, and so is desirable on that account. We do not really know what effect palatability has on digestibility, but from our knowledge of the physiology of digestion it may have an appreciable influence. It is well known that pleasant anticipation alone, in regard to food, causes an outpouring of saliva—the mouth “waters” at the sight or smell of interesting food, even before any of it is taken in—and experiments on dogs have shown that what is true of the salivary glands is also true of the gastric glands, so that the stomach “waters” at the same time as the mouth. It may be that the other glands further down the digestive tract are also influenced. Remembering that the food is broken down ready for absorption by ferments contained in these fluids, we must recognize a distinct possibility that palatability may be useful not only as a means of stimulating the appetite, but also as increasing the efficiency of digestion.

Again, there is always the danger of animals going off their feed to a certain extent if kept on one ration for a long time, and this means that a change of diet must be made. Changes in feeding are undesirable, for the composition of the digestive fluids is not entirely constant, but varies appreciably with the nature of the food that is eaten—this suiting of the fluids to the material on which they have to act has been demonstrated. A change of diet means, therefore, that the animal must produce rather different secretions, and there will always be a loss of efficiency during the change over, while we know that sudden and radical changes may cause quite serious illness. If a ration contains a fair mixture of foods, animals are less likely to get tired of it, and so can be kept on one diet for a longer time. Another point is that the rate of digestion varies as between food and food, so that a good mixture distributes the work of breaking down the feeding stuffs to assimilable form, and of absorbing them into the blood stream, more evenly over the digestive tract. This, it would appear, must increase the efficiency of the process.

The main scientific reason advanced in favour of variety in the ration is that it improves the biological value of the proteins. As has been pointed out previously in these Notes (June, 1929) proteins are made up of amino-acids, which occur in very different proportions in the different proteins. One of the simplest (glycine), for instance, is completely absent from zein, the protein found in maize, but is included in casein (the main milk protein), and in the protein forming the muscles of cattle. It is obvious, therefore, that the protein of maize is incomplete, and needs others to supplement it. Of course maize is not fed for its protein content, which is very low, but in every case there will be wide differences between the percentages of many amino-acids in any food protein and their percentages in the protein (casein, lean meat, etc.) which they go to form. In some cases one may be so deficient in the food that it limits the production of the required animal protein to a low level, and in all cases it is clear that there must be a large wastage of the amino-acids which the food contains in excess (the surplus can be used to supply energy, but its conversion is very wasteful). Now the argument is that if you include in the ration products from several different plants, the probability is that you will get a better mixture of amino-acids in the whole, and that the risk of having the productivity of the animal held up for lack of some particular amino-acid is reduced to a minimum. The latter point obviously follows, and is of great importance, for, in addition to those going to form the proteins produced by the animal, there are a number of amino-acids contained in the various body fluids, and their absence might have serious consequences.

But the whole thing is a step in the dark, and no one could call it scientific. What is wanted is a complete analysis of all proteins, both those in the common foods and those built up by animals, and then it would be possible to decide what particular proteins lack in the way of amino-acids, according to the purpose for which they are being fed, and what others are most suitable for making good their deficiencies. All this, however, waits for the chemist, who has not yet found a way to analyse proteins fully into their constituent amino-acids, though great progress is being made in that direction. This will add yet another complication to rationing, and it may well be imagined that the farmer of the future will find, as Alice did, that it is a very difficult game indeed : the reader will probably be rather glad that at the moment we have no basis on which to build up a ration whose proteins will be so mixed as to attain

their highest biological value, and that the only course open to us is that of feeding a variety of feeding stuffs, on the rather "hit-or-miss" principle that that will improve our chances of getting somewhere near the optimum. Professor Möllgaard, the distinguished Danish authority on nutrition, has, indeed, concluded that in general there is little improvement in the biological value of the proteins by using a wide mixture of foods, and that variety is only important if the total protein fed is low and just about the minimum requirement—that is, when the wastage of amino-acids must be kept very low or some will be deficient, and limit production.

As regards experimental demonstration of the desirability of variety in the ration, there is little or none. An article by Mr. Jesse, published in this JOURNAL (August, 1925), gave conclusions reached on the question from a statistical analysis of rations fed to dairy herds in East Sussex: he found that the herds getting the greatest number of different feeding stuffs were yielding the most milk. Since then Mr. Jesse has kindly handed over his data, together with a further winter's records, to the present writer, who has also studied this problem: with 2,252 returns of rations being fed, the writer found the following:—

<i>Number of Different Foods Included in the Ration</i>	<i>Number of Returns</i>	<i>Average Yield per Cow per Day lb.</i>
2	4	18.5
3	65	18.9
4	205	20.0
5	397	21.0
6	529	22.1
7	433	22.8
8	283	24.0
9	189	23.8
10	86	23.4
11	39	24.5
12	11	25.5
13	10	24.2
14	1	31.0

Very few people feed fewer than 4, or more than 10, different foods, and the average number lies between 6 and 7. The table shows conclusively that those herds given the greatest variety are producing the highest yields, for the figures in the last column rise steadily, with very few irregularities, all through. But can we draw what might appear to be the obvious conclusion—that yield is raised by variety? The writer has considerable doubt on this point, for it may be that, over these herds, the higher the yield the better the feeding, with which is

generally associated greater variety—that is that the yield may have been influential in determining the variety rather than the reverse.

This view was strengthened by a further analysis that was carried out : the effect of changes in feeding in particular herds was considered, by dividing them up according as the variety had been increased or decreased since the last return, and seeing whether the two groups showed any definite changes in yield since last time. If great variety increases yield then, on the average, those herds in which the diversity of the feeding stuffs was increased should have repaid it with a higher yield, and *vice versa* : but the result was negative, no definite change in yield being found in either group. Despite the above table, therefore, the writer regards it as not proven by these data that variety, of itself, has a beneficial effect on yield. What is certainly demonstrated is that the most successful milk producers do feed a larger variety than the least successful, and this alone might be taken as sufficient reason for recommending a varied ration. The data mentioned above cannot be expected to solve the question with scientific exactitude, for hay was counted as one food though, of course, it includes a number of closely related but, nevertheless, different plants. We may well agree with Professor Möllgaard that variety only assumes importance when the total protein intake is just about the minimum requirement—that is, in practice, with high yielding herds—and as we see above those are the ones which do include a large number of foods. It would be expected that a good cow would be handicapped by a ration of only 2 or 3 different foods, whilst a poor one would not be induced to do any better by a very varied one, but these two cases do not ordinarily arise in practical data. Surveying the whole question, it will probably be concluded that variety in the ration is desirable, at least with animals dealing with large quantities of nutriment, but that at the moment this conclusion rests on general considerations, and that a fetish should not be made of variety until its utility has been definitely demonstrated by experimental trials.

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British.. ..	—	—	9 15	0 11	9 4	72	2 7	1-38	9-6
Barley, British feeding ..	—	—	8 5	0 9	7 16	71	2 2	1-16	6-2
" Canadian feed ..	28 6	400	8 0*	0 9	7 11	71	2 2	1-16	6-2
" American ..	29 0	"	8 2	0 9	7 13	71	2 2	1-16	6-2
" Persian ..	31 6	"	8 17	0 9	8 8'	71	2 4	1-25	6-2
" Polish ..	28 6	"	8 0†	0 9	7 11	71	2 2	1-16	6-2
Oats, English, white ..	—	—	8 0	0 10	7 10	60	2 6	1-34	7-6
" black and grey ..	—	—	8 13	0 10	8 3	60	2 9	1-47	7-6
" Canadian No. 1 feed ..	27 3	320	9 10*	0 10	9 0	60	3 0	1-61	7-6
" " mixed " ..	19 0	"	6 13	0 10	6 3	60	2 1	1-12	7-6
" Argentine ..	22 6	"	7 17	0 10	7 7	60	2 5	1-29	7-6
" Chilian ..	22 6	"	7 17	0 10	7 7	60	2 5	1-29	7-6
" German ..	24 0	"	8 8	0 10	7 18	60	2 8	1-43	7-6
Maize, American ..	40 6	480	9 8§	0 9	8 19	81	2 3	1-20	6-8
" Argentine ..	35 9	"	8 7	0 9	7 18	81	1 11	1-03	6-8
" South African ..	39 3	"	9 3§	0 9	8 14	81	2 2	1-16	6-8
Beans, English winter ..	—	—	10 10†	1 3	9 7	66	2 10	1-52	20
Peas, " blue ..	—	—	10 8†	1 0	9 8	69	2 9	1-47	18
" Japanese ..	—	—	17 5§	1 0	16 5	69	4 9	2-54	18
Dari ..	—	—	8 10†	0 11	7 19	74	2 2	1-16	7-2
Rye, Home-grown ..	—	—	7 5	0 11	6 14	72	1 10	0-98	9-1
Millers' offals—									
Bran, British ..	—	—	6 10	1 1	5 9	42	2 7	1-38	10
" broad ..	—	—	7 10	1 1	6 9	42	3 1	1-65	10
Middlings, fine, imported ..	—	—	7 15	0 16	6 19	69	2 0	1-07	12
" coarse, British ..	—	—	7 2	0 16	6 6	58	2 2	1-16	11
Pollards, imported ..	—	—	6 12	1 1	5 11	60	1 10	0-98	11
Meal, barley ..	—	—	9 10	0 9	9 1	71	2 7	1-38	6-2
" maize ..	—	—	10 10	0 9	10 1	81	2 6	1-34	6-8
" " South African ..	—	—	8 15	0 9	8 6	81	2 1	1-12	6-8
" " germ ..	—	—	9 10	0 14	8 16	85	2 1	1-12	10
" locust bean ..	—	—	9 5	0 7	8 18	71	2 6	1-34	3-6
" bean ..	—	—	13 0	1 3	11 17	66	3 7	1-92	20
" fish ..	—	—	19 0	3 2	15 18	53	6 0	3-21	48
Maize, cooked flaked ..	—	—	11 0	0 9	10 11	76	2 9	1-47	19
" gluten feed ..	—	—	9 15	0 18	8 17	85	2 1	1-12	8-6
Linseed cake, English, 12% oil ..	—	—	14 5	1 7	12 18	74	3 6	1-87	25
" " " 9% " ..	—	—	13 12	1 7	12 5	74	3 4	1-75	25
" " " 8% " ..	—	—	13 7	1 7	12 0	74	3 3	1-74	25
Soya bean " " 5½% " ..	—	—	11 12	1 18	9 14	69	2 10	1-52	36
Cottonseed cake—									
English, 4½% " ..	—	—	7 12	1 6	6 6	42	3 0	1-61	17
" Egyptian, 4½% " ..	—	—	7 7	1 6	6 1	42	2 11	1-56	17
Coconut cake, 8% oil ..	—	—	10 10	1 3	9 7	79	2 4	1-25	16
Ground-nut cake, 6-7% oil ..	—	—	10 0†	1 5	8 15	57	3 1	1-65	27
Decorticated ground-nut cake, 6-7% oil ..	—	—	12 0†	1 19	10 1	73	2 9	1-47	41
Palm kernel cake, 4½-5½% " ..	—	—	9 15†	0 16	8 19	75	2 5	1-29	17
" " " meal, 4½% " ..	—	—	10 5†	0 16	9 9	75	2 6	1-34	17
" " " meal 1-2% oil ..	—	—	9 5†	0 17	8 8	71	2 4	1-25	17
Feeding treacle ..	—	—	6 7	0 8	5 19	51	2 4	1-25	2-7
Brewers' grains, dried ale ..	—	—	8 15	0 17	7 18	49	3 3	1-74	13
" " " porter ..	—	—	8 5	0 17	7 8	49	3 0	1-61	13
Malt culms ..	—	—	8 10§	1 5	7 5	43	3 4	1-78	16

* At Bristol.

† At Hull.

§ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of September and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manual value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.43d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manual value per ton figures are calculated on the basis of the following unit prices: N, 6s. 6d.; P, 5s.; S, 5s.; K, 3s. 2d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	8 5
Maize	81	6.8	8 19
Decorticated ground nut cake	73	41.0	11 15
„ cotton cake	71	24.0	11 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2.21 shillings, and per unit protein equivalent, 2.07 shillings.

In accordance with the recommendation of the Departmental Committee on Rationing of Dairy Cows,* the “food values” given in the following table may be taken as applicable to the ensuing four months, December to March, inclusive, for the purposes of advisory schemes on the rationing of dairy cows.

FARM VALUES

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Roots—	Per cent.	Per cent.	
Kohl Rabi	8	0.5	0 19
Mangolds	7	0.4	0 16
Potatoes	18	0.6	2 1
Swedes	7	0.7	0 17
Turnips	5	0.4	0 12
Green foods—			
Cabbage, drumhead	7	0.9	0 17
„ open-leaved	9	1.5	1 3
Kale, marrow stem	9	1.3	1 2
Silage, vetch and oats	13	1.6	1 12
Hay—			
Clover hay	32	7.0	4 5
Lucerne hay	24	7.9	3 9
Meadow hay, poor	19	2.9	2 8
„ „ medium	31	4.6	3 18
„ „ very good	40	7.8	5 4
Seeds hay	24	4.9	3 3
Straws—			
Barley straw	19	0.7	2 2
Bean straw	19	1.7	2 5
Oat straw	17	0.9	1 19
Wheat straw	11	0.1	1 4
Grains and seeds—			
Barley	71	6.2	8 10
Beans	66	20.0	9 7
Oats	60	7.6	7 8
Peas	69	18.0	9 10
Wheat	72	9.6	8 19

* Report obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d. net.

MISCELLANEOUS NOTES

THE Ministry's publications continue to supply a distinct need on the part of agriculturists and horticulturists. This is borne out by the sale figures for the first

The Ministry's Publications half of the present financial year. Of the Sectional Volumes of Collected Leaflets on related subjects, no fewer than 7,089

copies have been sold during that period, while the sales of Miscellaneous Publications, including Research Monographs, totalled 8,151 copies. Works such as the *Handbook of British Breeds of Livestock*, *Rations for Livestock*, *Pig-keeping*, and *The Planning of Poultry Houses* retain their popularity, and new editions continue to be called for. The sales of these four publications during the half-year have been 351, 616, 449 and 577 copies, respectively. The sales of certain other publications during the same period have been as follows: No. 37, *Beneficial Insects* (2nd Edition), 398 copies; No. 40, *The Construction of Cow-Houses* (2nd Edition), 351 copies; No. 55, *The Sex-Linked Method in Poultry-Breeding* (2nd Edition), 313 copies; No. 61, *Weeds of Arable Land* (published in July), 302 copies; No. 64, *The Culture of Fish in Ponds*, 710 copies; No. 65, *Variations in the Composition of Milk*, 898 copies.

Three volumes have recently been added to the series, namely: No. 66, *Rice Grass—Its Economic Possibilities*; No. 67, *Agricultural Machinery and the Organization of Agricultural Labour in Australia, New Zealand and Canada*, and Research Monograph No. 6, *A Survey of the Soils and Fruit of the Wisbech Area*.

A complete list of the Ministry's publications will be sent free and post free, on request.

* * * * *

THE number of millers and packers authorized to pack All-English Wheat Flour under the National Mark is now 137.

A complete list of their names and addresses is as follows:—

National Mark Wheat Flour Scheme

LIST OF AUTHORIZED PACKERS UNDER THE NATIONAL MARK SCHEME FOR ALL-ENGLISH WHEAT FLOUR

London

Associated London Flour Millers, Ltd., Haddon House, Fenchurch Street, E.C. (in respect of subsidiary companies included below).
Burgess Martin, Ltd., Vestry Road, Camberwell, S.E. 5.
C. Carwardine & Co., 12 Nicholay Road, N. 19.
Thos. E. Carwardine & Co., Ltd., 138 Kingsland Road, E. 2.

Civil Service Supply Association, Ltd., 136 Queen Victoria Street, E.C. 4.

Essex Flour and Grain Co., Ltd., Liverpool Road, N.1.

Harrods, Ltd., Knightsbridge, S. W. 1.

C. F. Holdstock, 160 Hoe Street, Walthamstow.

Hovis, Ltd., 154 Grosvenor Road, S.W. 1. (and branches).

Joy's, Ltd. (The V.V. Bread Co.), Dawes Road, Fulham, S.W. 6.

Peter Keevil & Sons, Ltd., Edgware Road, W. 2.

J. Limmer & Son, Ltd., Digswell Street, N. 7.

McDougalls, Ltd., Wheatsheaf Mills, Millwall Docks, E. 14 (and branches).

Marriage, Neave & Co., Ltd., Albert Bridge Flour Mills, Battersea, S.W.

W. Melhuish, Ltd., Camberwell Green, S.E. 5.

S. P. Mumford & Co., Ltd., The Flour Mills, Greenwich, S.E. 10.

H. W. Nevill, Ltd., The Bakery, Acton, W. 3.

One & All Flour Co., 200 East Hill, Wandsworth, S.W. 18.

Queenfisher Flour Co., The Flour Mills, Greenwich, S.E. 10.

J. and H. Robinson, Ltd., Deptford Bridge Mills, S.E. 8.

Sun Flour Mills Co., Ltd., St. Leonard Street, Bromley-by-Bow, E.

Seth Taylor, Ltd., St. Saviours Mills, Mill Street, Dockhead, S.E. 1.

Reds

Hipwell & Sons, Stoke Mills, Sharnbrook.

Alfred Thorne, Eaton Bray, Dunstable.

Berks

Clarks (Wantage), Ltd., Town Mills, Wantage.

Joseph Fuller & Son, 65-67, Queen Street, Maidenhead.

Over Bros., Sindlesham Mills, Wokingham.

Bucks

Francis Coales & Son., Newport Pagnell.

Cambs

Clark & Butcher, Ltd., Soham, Ely.

Foster Mills, Station Road, Cambridge.

F. Leach & Sons, Roller Mills, Wisbech.

Linton Milling and Corn Co., Linton.

James Nutter, Station Mill, Fulbourn.

Joseph Smith & Co., Ltd., Roller Flour Mills, March.

Sanders Bros. (Stores), Ltd., Chaston's Flour Mills, Great Shelford.

Derby

Unwin Sowter, Ltd., Sowter Road, Derby.

Devon

Baker & Ferguson, Victoria Flour Mills, Barnstaple.

Morrish & Son, Weycroft Roller Mills, Axminster.

Taw Valley Flour Co., 2 Tuly Street, Barnstaple.

Philip Trant & Sons, Ltd., Town Mills, Kingsbridge.

Dorset

W. H. Yeatman & Sons, Ltd., Victoria Flour Mills, The Quay, Poole.

Essex

E. T. Baker & Sons, Fullbridge Roller Flour Mills, Maldon.

C. A. Chambers, 726 Romford Road, Manor Park, E. 12.

Clover's, Ltd., Dedham (and branches).

Cramphorn, Ltd., Warley Hill, Brentwood (and branches).

Goulds, Ltd., Loughton (and branches).

A. J. Holland, Ltd., Flour Mills, Audley End Station, Saffron Walden.

E. Marriage & Son, Ltd., East Mills, Colchester.

W. and H. Marriage & Son, Chelmer Mill, Chelmsford.

J. and G. H. Matthews, Ltd., Harold Wood (and branches).
A. M. and H. Rankin, Ltd., Stambridge Steam Mills, Rochford.
T. D. Ridley & Sons, Ltd., Stream Mills, Chelmsford.
R. E. Smith, Parndon Flour Mills, Harlow.

Glamorgan

The Pioneer Trading Co., 19 and 20 Tredegar Street, Cardiff.
Spillers, Ltd., Cardiff.

Gloucester

H. H. and S. Budgett & Co., Ltd., Nelson Street, Bristol.
Henry Cole & Co., Ltd., Cotswold Flour Mills, Cirencester.
Humphries & Bobbett, Ltd., Castle Flour Mills, Queen Street, Bristol.
Henry Jones (Bristol), Ltd., Broadmead, Bristol.
Mitchells Diadem Flour Co., Ltd., 21 Beaufort Street, Easton, Bristol.
T. and H. Wilkins, Ltd., V.O.B. Flour Mills, Bourton-on-the-Water.
Victoria Flour Co., Ltd., Bristol.

Hants

Simmons & Gifford, Ltd., Wharf Mills, Winchester.
R. Simmonds & Son, Aldershot.

Hereford

Hereford Flour Mills, Bath Street, Hereford.
South Herefordshire Agricultural Co-operative Society, Ltd., Town Mills, Ross.

Herts

Jas. Bowman & Sons, Ltd., Station Flour Mills, Hitchin.
Chapman, Bros., Standon Flour Mills, Ware.
S. Edwards & Son, Beech Flour Mills, Bishops Stortford.
J. W. French & Co., Ware Flour Mills, Ware.
G. Garratt & Sons, Sele Roller Mills, Hertford.
T. H. Smith & Sons, Ltd., Flour Mills, Royston.

Hunts

Bowyer and Priestley, Ltd., Offord and Buckdon Mills, Huntingdon.
Browns and Goodmans, Ltd., Huntingdon.
Jordon and Addington, St. Neots.
Paine & Co., Ltd., St. Neots.

Kent

G. W. Chitty & Co., Ltd., Charlton Mill, Dover.
Cannon & Gaze, Ltd., The Flour Mills, Erith.
Daren, Ltd., Dartford.
W. Hooker & Son, Westgate Mills, Canterbury.
C. J. Hudson, Ltd., Isle of Thanet Flour Mills, Ramsgate.
Kingsford & Co., Barton Mills, Canterbury.
Medway Milling Co. Ltd, Maidstone.
H. S. Pledge & Sons, Ltd., Victoria Flour Mills, Ashford.
William Taylor & Co. (Maidstone), Ltd., 69 Bank Street, Maidstone.
"Seraffo," Ltd., Dartford.

Lancs

H. and R. Ainscough, Burscough Mills, Burscough.
Co-operative Wholesale Society, Ltd., Manchester (and six mills).

Leicestershire

Goodacre & Everard, Ltd., Loughborough.
Leicester Co-operative Society, Ltd., Flour Mill Depot, Ash Street, Leicester.
F. R. Thompson & Sons, Ltd., Roller Flour Mills, Bay Street, Leicester.

Lincs

W. and W. Bedford, Ltd., Phoenix Mills, Boston.
Henry Le Tall, Ltd., 8 and 9, Guildhall Street, Lincoln.

A. W. Tindall, Ltd., Barrington Mills, Holbeach.
Whittons, Ltd., 25 Bridge Street, Gainsborough.

Middlesex

Samuel Kidd & Co., Ltd., The Flour Mills, Isleworth.

Norfolk

Barclay Pallett & Co., Ltd., Aylsham.
F. A. Bird, Downham Mills, Ltd., Downham.
J. and J. Colman, Ltd., Carrow Works, Norwich.
Dewing and Kersley, Ltd., Fakenham.
R. J. Read, Ltd., City Flour Mills, Norwich.
C. E. Woodrow, Tower Roller Mills, Norwich.

Notts

E. Caudwell, Ltd., Southwell.
J. & R. Hutchinson, Ltd., Nottingham.

Oxford

Clarks (Banbury) Ltd., Station Mills, Banbury.
F. W. P. Matthews, Ltd., Shipton-under-Wychwood.
W. H. Munsey, Ltd., Osney Roller Flour Mills, Oxford.
C. H. Witherington & Son, Sonning Mills, near Reading.

Salop

A. and A. Peate, Maesbury Hall Mills, Oswestry.

Suffolk

Edward Baker, Ltd., Cornard Mills, Sudbury.
J. W. and F. W. Baker, Lavenham.
Geo. Cooper & Son (Needham Market) Ltd., Needham Market.
A. A. Gibbons, Ltd., "Westend" Flour Mills, Ipswich.
Walter Green, Castle Flour Mills, Beccles.
Marriage and Hicks, Southgate Mills, Bury St. Edmunds.
C. C. Marston, Earsham Mill, Bungay.
Parker Bros. (Mildenhall), Ltd., "The Lark" Roller Mills,
Mildenhall.
H. F. Pearce, Wortham, near Diss.

Surrey

A. H. Allen & Co., Ltd., Croydon.
J. & W. Attlee, Parsonage Mills, Dorking.
C. A. Botting & Sons, Albury Mills, Guildford.
Coxes Lock Milling Co., Weybridge.
H. and A. Trower, Earlswood, Redhill.

Sussex

Sadler & Co., Westhampnett Mills, Chichester.

Warwick

Adkins & Thomas, Broom Mills, Bidford-on-Avon.
J. Drew & Sons, Ltd., Perry Barr Mills, Birmingham.
Kench & Son, Ltd., Warwick.
C. B. Lowe (1920), Ltd., Sheepy Flour Mills, Atherstone.
Nuneaton Flour Mills, Ltd., The Mills, Nuneaton.
Robbins & Powers, City Flour Mills, Coventry.
Spencer, Son and Hancox, Great Alne Mills, Alcester.

Worcs

Goodwin, Foster Brown, Ltd., Parsons Street, Dudley.

Yorks

E. B. Bradshaw & Sons, Driffield.
Russells and Wrangham, Ltd., Malton.
Samuel Smith (Sheffield), Ltd., Victoria Corn Mills, Sheffield.
Thirsk & Sons, Nafferton.
E. Timm & Son, Ltd., Goole.
F. T. Wood & Sons, Birstwith, Harrogate.

Suggestions have been made that the Scheme should be extended to cover (a) flour factors, and (b) small country retailers who usually purchase All-English Wheat Flour in sacks from millers, but may not at present repack the flour in small containers under the National Mark because their inability to handle 50 cwt. of flour per week precludes them from applying for authorization. Both these suggestions have been considered by the Wheat Flour Trade Committee, but the Committee feel that the amount of supervision required for the Scheme during its initial stages renders extension in either direction inadvisable at present.

Orders for labels are rapidly approaching the figure of one million, the largest orders being for 1-lb. packet labels for "Self-raising" and "Plain" flours respectively. More than 12,000 display window strips and poster cards have been issued to authorized millers and packers for distribution to retailers handling National Mark flour.

Inquiries continue to be received by the Ministry regarding the supply of labels for "National Mark Bread" by which is meant, of course, bread made wholly from National Mark flour. As there appears to be some misapprehension on the point, it may be said that bread is not covered by the existing flour scheme, and that there is no intention of drawing up a scheme to cover bread, biscuits or other products made wholly from National Mark flour.

All authorized millers and packers have been asked to send samples of their first run or blend of National Mark flour for inspection by the Wheat Flour Trade Committee. Some of the samples already examined are of very fine quality, particularly the "Yeoman" grades.

* * * * *

VOLUME Seven of the Guide to Current Official Statistics (price 1s. net, post free 1s. 4d., pp. 312) has recently been issued, and may be obtained direct from the sale offices of His Majesty's Stationery Office or through any bookseller. This publication is prepared and issued annually by the Permanent Consultative Committee on Official Statistics, and gives not only a list, arranged under Departments, of all current official publications containing statistical information, but also a detailed index of subjects, in which are indicated the exact characteristics, as regards date and place, of the statistics to which reference is made. Special devices are employed to facilitate the use of

this index by even the most casual inquirer, and to enable the appropriate reference to published official statistics on any subject to be readily traced.

* * * * *

SMALLHOLDERS and cottagers who keep goats are reminded that the Scheme for improving the productive quality of their milch stock is again in operation.

**Stud Goat
Scheme,
1929-30**

For the current service season, which ends on February 28, 1930, 105 registered stud goats are standing at various centres throughout the country including 13 in

Wales, and their services are available for goats belonging to persons in the above-mentioned categories at a nominal fee, in no case exceeding 5s. Conditions of service and other particulars may be obtained from the County Agricultural Organizers at their respective County Education Offices, or from the Honorary Secretary of the British Goat Society, which is responsible for the administration of the Scheme, at 10, Lloyd's Avenue, London, E.C. 3.

* * * * *

THE following note has been communicated by Dr. T. Milburn :—

Custom

Custom is defined in Chambers's Dictionary as "What one is wont to do ; usage ; frequent repetition of the same act, etc." Having regard to these definitions we realize how largely custom enters into farming operations, farm transactions and farm tenancies. Custom, in the writer's opinion, is "A good servant but a bad master." Custom varies from district to district, owing to climatic and other conditions, and it is usually wise when a farmer moves to another farm remote from where he has had experience, to pay some regard to the customs prevailing in his new surroundings. His first impressions will no doubt be that many details of farm management which are not in accord with his experience are wrong, but a few years in his new surroundings will probably suffice to teach him otherwise : in such cases custom is a good servant and guide. The system of preparation of land for crops and of harvesting crops in the north and west must of necessity differ in detail from that in the east and south ; both may be good, but both may be capable of modification and improvement. Hence, whilst what has been written above is in the main sound, it follows that a shrewd good farmer may in a new district be able to improve on local

customs, but he should move slowly or he may pay dearly for his experience.

The influence of custom is probably strongest in the case of remote outlying areas, where in the past there have been few opportunities for learning first hand of improved methods, few lectures, few experiments and little or no co-operation. In such cases the son may follow the father through successive generations in his methods and customs, and be less open to change or suggested improvements than he might be. Custom so deeply rooted is a bad master. With improved methods of transport, increased propaganda by county staffs, wireless, increased organization amongst farmers, etc., this type is rarer than was the case 30 or 40 years ago, but is still too numerous. Apart from the depressed conditions under which farmers are labouring, there is room for greater initiative, better organization and improvement of methods. Custom should be the guide, not the master. Built up as it is on past experiences, custom is a vital factor in farming operations, but the custom of one period may be out of date in the next; the experiments of one decade may be the recognized custom of the next.

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THE following note has been communicated by the National Institute of Agricultural Botany:—

Winter Wheats.—The season of
Varieties of 1928-29 provided an altogether exceptional
Cereals for test of winter-hardiness. In a year when
Autumn Sowing long and bitter frosts were followed by
 drought and a cold spring it was inevitable that there should be a number of crop failures. The popular impression that red wheats are hardier than white was not borne out; all the better-known varieties are in fact hardy enough for ordinary English conditions. The rest of the season was unusually favourable to wheat; there was no serious lodging and very little disease. Loose smut was, however, noticed in stocks of Ideal, Setter and Colossus, and farmers who purchase these varieties should obtain a guarantee that the seed is free from infection, as it cannot be controlled by the usual seed dressings.

All the newer varieties of wheats were grown in 1928-29; some of them have serious defects, and even the best must still be regarded as on probation. The only varieties which the Institute is at present able definitely to recommend are Wilhelmina and Victor as the most reliable high yielding varieties on soils in good condition; Yeoman or Yeoman II for the richest

soil conditions and because of their unique quality ; Little Joss on the lighter wheat soils or where fertility is relatively low ; Iron III (though it is less reliable than Wilhelmina and may suffer from rust) and Weibull's Standard on heavy soils. Rivett, or Blue Cone, probably outyields all other varieties on heavy soils in the South of England, and Squarehead's Master stands by itself in its adaptability to all sorts of conditions and the regularity with which it gives a respectable crop.

Winter Oats and Barleys.—The hard winter drove home the lesson that the weak-strawed Grey Winter oats and the ordinary coarse-grained six-row winter barley are the only available varieties of these crops which are completely hardy. In fact even these succumbed in some cases to the drought which followed the frost. Thanks to some happy circumstance of soil or climate other varieties survived here and there, but the situation in the case of these two crops can be summed up by saying that of the white oats none is truly winter-hardy. *Plentiful* is the least susceptible but otherwise without special merit, and *Marvellous* is best left for early spring sowing. Of the black oats, *Bountiful*, from which Giant Black Winter is indistinguishable, has a stout straw, yields well when it survives, and is hardier than the white sorts ; and *Black Winter* is next to Grey Winter in hardness, very little stronger in the straw and not of quite the same quality in grain. In the case of the barleys the only alternative to the ordinary six-row is to use one of the two-rowed spring types ; if exposed situations and ill-drained soils are avoided there is a reasonable chance of success with Plumage-Archer, Spratt-Archer, and Archer (or Sunrise).

Fuller information about all the principal varieties of cereals can be obtained from the National Institute of Agricultural Botany, Huntingdon Road, Cambridge.

* * * * *

THE fifth annual award of scholarships from the United Dairies Scholarship Fund has recently been made. This fund, which amounts to £30,000, was created in

United Dairies Scholarships

1924 by the United Dairies, Ltd., for the purpose of promoting and encouraging practical and scientific education in dairying and dairy farming. The fund also provides for one or more travelling and research scholarships to enable advanced students to study these subjects at home and abroad.

The scholarships, which are open to the sons and daughters of farmers and small holders in Somerset, Cornwall, Devon,

and Dorset, are tenable at Reading University, the Somerset Farm Institute (Cannington, Bridgwater), and the Seale-Hayne Agricultural College (Newton Abbot, Devon). Eight ordinary scholarships were awarded this year, the successful candidates being as follows :—

Two Years' Diploma Course in Dairying at Reading University—

Miss Addice D. Arthur, Miss Kathleen D. Maddever,
Miss Beatrice E. M. Northey, Miss Marjorie S. Voysey,
Geo. Bartlett Read.

Short Course in Agriculture at Seale-Hayne Agricultural College—

Charles A. Green.

One Year's Course in Dairying at Somerset Farm Institute, Cannington—

Miss Sylvia F. Sage, Miss Sarah E. Manley.

Miss Maddever was awarded a one year's course in dairying at the Somerset Farm Institute in 1928, and the latest award will enable her to continue her training in dairying work.

The terms and conditions of both ordinary and research scholarships for next year will be issued about July.

* * * * *

PRICES of agricultural produce during September were on average 52 per cent. above those ruling in the base years, or the same as in August, but 8 points

The Agricultural Index Number above the level recorded in the corresponding month a year ago. Values for cereals and livestock were lower as a rule,

but these reductions were offset by the higher index figure for milk.

Percentage increase compared with the
average of the corresponding month in
1911-13

Month	1924	1925	1926	1927	1928	1929
January	60	71	58	49	45	45
February	61	69	53	45	43	44
March	57	66	49	43	45	43
April	53	59	52	43	51	46
May	57	57	50	42	54	44
June	56	53	48	41	53	40
July	53	49	48	42	45	41
August	57	54	49	42	44	52
September	61	55	55	43	44	52
October	66	53	48	40	39	—
November	66	54	48	37	41	—
December	65	54	46	38	40	—

Grain.—Prices of wheat fell by 1s. 10d. to an average of 9s. 10d. per cwt., while oats declined by 1s. 2d. to 7s. 11d. per

cwt., and the relative index numbers were 15 and 13 points lower at 31 and 17 per cent. above pre-war. In the case of barley, the advance in values was proportionately less than in the base years, and the index figure at 27 per cent. above 1911-13 was 4 points down on the month. As compared with September last year, wheat was 8d. per cwt. dearer, but barley and oats were 1s. 11d. and 1s. 1d. respectively cheaper.

Live Stock.—A further slight fall was recorded in quotations for fat cattle, and the index number declined by 2 points to 34 per cent. in excess of the base level. Fat sheep averaged 11½d. per lb. for 2nd. quality or ¼d. less than in August, and the index number fell to 55 per cent. over 1911-13. Amongst fat pigs, baconers became cheaper by 7d. per 14 lb. stone, but the reduction in the case of porkers amounted to only 1d., the index figures for both descriptions were lower at 52 and 55 per cent. respectively over pre-war. The continued poor demand for store cattle was reflected in the decline in values of 6s. per head, and the index number was 3 points below that recorded in the previous month. Dairy cows again realized higher prices, as is customary at this season of the year and the index figure was unchanged. Both store sheep and store pigs failed to maintain August prices, and the index numbers fell by one and two points respectively to 63 and 83 per cent. above 1911-13.

Dairy and Poultry Produce.—In most districts, prices of milk were at winter levels during the month under review, and the index number was higher at an average of 107 per cent. above the base years. Butter became a little dearer, but cheese was 9s. per cwt. cheaper, and the index figure declined by 20 points to 42 per cent. in excess of pre-war. Eggs continued to increase in price, but the rise of 1½d. per dozen was proportionately less than in the corresponding period of 1911-13, and the index number consequently showed a slight reduction. Values for poultry were 45 per cent. above those ruling in September of the base years, as compared with 47 per cent. in the preceding month.

Other Commodities.—Potatoes averaged £4 3s. per ton, or 12 per cent. more than in 1911-13. There was a further advance in quotations for hay, the increase amounting to 2s. per ton in the case of clover hay and 3s. 6d. for meadow hay, and the combined index for both kinds of hay was one point higher on the month at an average of 42 per cent. over pre-war. As compared with September, 1911-13, apples were about 37 per cent. and plums 87 per cent. dearer, but pears were not

materially altered. The index figure for vegetables appreciated by 16 points to 26 per cent. in excess of pre-war.

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1927	1928	1929			
	Sept.	Sept.	June	July	Aug.	Sept.
Wheat	48	22	21	28	46	31
Barley	62	50	33	30	31	27
Oats	35	33	26	23	30	17
Fat cattle ..	30	36	31	30	36	34
Fat sheep ..	45	59	59	55	59	55
Bacon pigs ..	34	33	70	64	60	52
Pork pigs ..	41	32	65	61	60	55
Dairy cows ..	28	34	30	33	35	35
Store cattle ..	24	27	22	25	19	16
Store sheep ..	49	66	65	60	64	63
Store pigs ..	64	28	77	80	85	83
Eggs	54	52	40	57	59	57
Poultry	37	42	63	57	47	45
Milk	65	65	57	57	93	107
Butter	41	54	46	52	48	52
Cheese	59	78	67	67	62	42
Potatoes	46	60	—34*	—4*	2	12
Hay	18	14	27	29	41	42
Wool	43	76	50	45	47	47

* Decrease.

* * * * *

THE following is a summary of the recently revised results for Great Britain of the 1928-29 beet sugar manufacturing season as compared with the previous year.

Beet Sugar The figures are of particular interest, as **Campaign, 1928-29** 1928-29 was the first year of the new rate of subsidy. It will be observed that the acreage under sugar beet declined sharply from 232,918 acres in 1927 to 178,049 acres in 1928. This lost ground has, however, been almost completely regained this year, the preliminary returns for June 4, 1929, showing the acreage under sugar beet as 230,900.

	1928-29	1927-28
Acreage under sugar beet ..	178,049	232,918
Average yield per acre (tons) .	7.69	6.45
Number of beet growers ..	26,291	33,340
Number of factories ..	19	19
Average number of days worked	72	106
Number of workers employed in factories during the campaign	8,172	9,022

Tonnage of beet delivered to factories	1,369,781	1,503,019
Average sugar content of beets (per cent.)	17.4	16.1
Average price paid per ton of beet	51s. 11½d.	55s. 4½d.
Estimated total sum, including cost of transport, paid by the factories to the growers	£3,559,000	£4,147,000
Total production of sugar (cwt.)	3,904,194*	3,802,189
Average extraction of sugar expressed as a percentage of beets delivered to factories .	14.2	12.6
Average extraction of sugar expressed as a percentage of total sucrose in beets ..	82.0	78.5
Average farm output of sucrose per acre of beet grown (lb.)	2,995	2,330
Average factory output of commercial sugar per acre of beet grown (lb.)	2,456	1,828
Production of by-products :—		
Molasses (cwt.)	975,934*	1,144,525
Pulp† (Dry (tons)) ..	97,451‡	91,436
(Wet (tons)) ..	8,208‡	16,163
Subsidy paid :—		
Sugar	£2,534,507*	£3,705,005
Molasses	£289,091*	£509,055
Total	£2,823,598*	£4,214,060

* Subject to slight adjustment.

† The figures relating to pulp production were reviewed in detail in this JOURNAL for September, 1929.

‡ Excluding the production of the desiccation process factory at Eynsham.

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ON the 18th October, the Minister gave notice in the *London Gazette* that in pursuance of the

**National Mark
Scheme for
Malt Products**

powers conferred on him by Sections 1 and 2 of the Agricultural Produce Grading and Marking Act, 1928, he proposes to make for the purposes of the Act, the following regulations :—

Agricultural Produce (Grading and Marking) (Malt Flour and Malt Extract) Regulations, 1929.

Copies of the draft regulations can be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2., or through any bookseller, price 1d. exclusive of postage.

THE following conditions for milk contracts during the year, October, 1929, to September, 1930, were approved by the Permanent Joint Milk Committee on September 18, viz. :—

**Milk Contract
Prices, 1929-30**

Milk during the 1929-30 contract period to be sold and bought in three classes. The producer to declare at the time of making his contract the class under which he elects to sell, and also to state his basic quantity. The first class to be sold and bought with a permissible variation of 10 per cent. each way from the basic quantity; the second class with a permissible variation of 20 per cent. each way from the basic quantity, and the third class with a permissible variation of 50 per cent. each way from the basic quantity.

For all milk above or below the margin of variation the producer to pay a penalty of 2d. per gallon, but the buyer to take all supplies in October, August and September, during which months no restrictions or penalties would be enforced.

The prices for the three classes are as follow :—

			Class 1 10 per cent. variation	Class 2 20 per cent. variation	Class 3 50 per cent. variation
			s. d.	s. d.	s. d.
October, 1929	..	..	1 4	1 4	1 4
November „	..	..	1 5	1 4	1 4
December „	..	..	1 5	1 5	1 5
January, 1930	..	..	1 5	1 5	1 4
February „	..	..	1 5	1 4	1 4
March „	..	..	1 4	1 4	1 3
April „	..	..	1 0	1 0	1 0
May „	..	..	1 0	1 0	0 11½
June „	..	..	1 0	1 0	0 11½
July „	..	..	1 0	1 0	1 0
August „	..	..	1 0	1 0	1 0
September „	..	..	1 4	1 4	1 4
			14 8	14 6	14 3

Creamery prices are to be as mentioned above, less actual railway carriage, and less 1d. per gallon in each month of the year except April, May and June, when the deduction would be 1½d. per gallon.

It will be noted that the new system dispenses with the “accounting period” for fixing the basic quantity and the monthly variations in percentages for deliveries and prices of surplus milk which were features of previous contracts.

A **MARKETING** demonstration, limited to bacon, was given at the third annual show and sale of the North-Western Commercial Pig Society at Whitchurch.

Marketing Demonstrations at Agricultural Shows At this Show, there were competitive live pig classes for baconers (Wiltshire and Midland) and for cutters and porkers, the entries numbering 61 and comprising 221 pigs. There were also carcass classes.

All classes were based on the weight categories suggested in Chapter XIII of the Ministry's Report on the Marketing of Pigs. After the judging, this enterprising society held, for the second successive year, a sale by live weight, at which very satisfactory prices were realized, the conditions of sale appearing to satisfy both buyers and sellers.

* * * * *

THE Ministry desires to announce a reduction in the fee charged at its Veterinary Laboratory for carrying out individual blood agglutination tests in the case of

Laboratory Tests for Bacillary White Diarrhoea birds suspected of being carriers of bacillary white diarrhoea. The charge hitherto has been 6d. per bird : in future it will be 3d., and the reduction comes

into effect at once.

The Ministry realizes that this disease is one of the greatest handicaps which the poultry industry has to face at the present time, inasmuch as it makes the breeding of healthy chicks almost impossible on many farms. Most poultry keepers know that the agglutination test is the most practicable means of identifying the "carrier" hens which transmit the disease through their eggs to the chicks. The evidence available shows, however, that only a small proportion of the breeding flocks in this country are being subjected to this valuable test, which provides a simple and comparatively inexpensive means of eradicating the disease in an infected flock, or, providing certain precautions are taken, of protecting a clean flock against infection. Poultry keepers are therefore urged to have their breeding flocks tested, before the breeding season begins, at any reliable laboratory which undertakes the work.

Applications for tests to be carried out at the Ministry's Laboratory should be addressed to The Director, Veterinary Laboratory, New Haw, Weybridge, who will promptly supply instructions and further particulars in reply to inquiries.

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1929

PRODUCE OF HOPS

PRELIMINARY STATEMENT showing the ESTIMATED TOTAL PRODUCTION OF Hops in the years 1929 and 1928, with the ACREAGE and ESTIMATED AVERAGE YIELD per STATUTE ACRE in each COUNTY of ENGLAND in which Hops were grown, and the AVERAGE YIELD per ACRE of the TEN YEARS 1919-1928.

Counties, etc.	Estimated total produce		Acreage returned on June 4		Estimated average yield per acre		Average of the ten yrs., 1919-28
	1929	1928	1929	1928	1929	1928	
	Cwt.	Cwt.	Acres	Acres	Cwt.	Cwt.	Cwt.
Kent { East ..	57,000	41,000	3,311	3,280	17.2	12.6	13.4
Mid ..	77,000	58,000	4,900	4,947	15.8	11.6	13.6
Weald ..	99,000	63,000	6,661	6,583	14.8	9.6	12.0
Total, Kent	233,000	162,000	14,872	14,810	15.7	10.9	12.8
Hants	17,000	12,500	1,012	987	16.7	12.7	11.1
Surrey	1,900	1,800	161	158	12.0	11.5	11.3
Sussex	36,000	22,000	2,139	2,147	16.8	10.1	11.7
Hereford ..	50,000	30,000	3,855	3,779	12.9	8.2	9.6
Worcester ..	20,000	12,700	1,818	1,794	11.2	7.1	9.9
Other Counties*..	1,200	1,000	129	130	9.4	7.6	8.3
TOTAL ..	359,100	242,000	23,986	23,805	15.0	10.2	11.9

* Salop, Gloucester and Berkshire.

Note.—The hop crop of 1929 was produced under very favourable conditions, and on the slightly increased acreage as compared with the previous year gave a yield per acre well above the average. The quality of the crop was generally reported to be excellent. The total production in England is estimated at 359,100 cwt., or 117,000 cwt. more than in 1928, and 74,000 cwt. above the average for the ten years 1919-28. Over the whole of the hop growing areas the average yield per acre is estimated at 15 cwt. compared with an average of 10.2 cwt. in 1928 and 11.9 cwt. for the previous ten years. An improvement in the yield per acre was noticeable in all hop growing districts, the greatest increase being in Sussex, where the average yield per acre for the county was 16.8 cwt. compared with 10.1 cwt. in 1928. Hampshire with 16.7 cwt. per acre showed relatively less improvement, the yield for this county in 1928 being 12.7 cwt. per acre. These two counties showed a higher yield per acre than any other hop growing district except East Kent, where the yield was 17.2 cwt. per acre. Hereford and Worcester with 12.9 cwt. and 11.2 cwt. per acre respectively were 4.7 cwt. and 4.1 cwt. per acre higher than in the previous year. Surrey with 12 cwt. per acre returned only $\frac{1}{2}$ cwt. more per acre than in 1928.

About 65 per cent. of the total crop was grown in Kent, where the total production for the county was 233,000 cwt. compared with 162,000 cwt. in 1928. The yield per acre for the whole county was 15.7 cwt. or 4.8 cwt. per

acre more than in 1928, and nearly 3 cwt. above the average for the previous ten years. The improvement in the yield per acre was most marked in the Weald which gave 5.2 cwt. per acre more than in the previous year, while in the East and Mid-Kent districts the yield per acre was about 4.5 cwt. higher than in 1928.

* * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on Tuesday, September 24, 1929, at 7 Whitehall Place, London, S.W. 1, Mr. W. B. Yates, C.B.E., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying these decisions into effect.

Gloucestershire.—An Order to come into operation on October 6, 1929, *i.e.*, the day following that on which the existing rates are due to expire, and to continue in force until October 4, 1930. The minimum rates in the case of male workers of 21 years of age and over are for head carters 34s. 6d. per week of 58 hours in summer and 36s. per week of 60 hours in winter; head shepherds and head stockmen 36s. per week of 60 hours all the year round; under-carters 32s. 6d. per week of 54 hours in summer and 34s. 6d. per week of 57 hours in winter; under-shepherds and under-stockmen 34s. 6d. per week of 57 hours all the year round, and other male workers 30s. per week of 50 hours in summer and 48 hours in winter. The overtime rates in the case of all classes of male workers are 11d. per hour on Sundays, Christmas Day and Good Friday (this rate is applicable in the case of workers of the special classes to employment in excess of three hours only on each of those days) and for other overtime employment 9d. per hour. In the case of female workers the minimum rate is 5d. per hour irrespective of age for all time worked.

Lincolnshire (Holland).—An Order to come into operation on October 27, 1929, *i.e.*, the day following that on which the existing rates are due to expire, and to continue in force until October 25, 1930. The minimum rate in the case of male workers of 21 years of age and over is 35s. per week of 50 hours in summer and 48 hours in winter with in addition, in the case of cattlemen and shepherds, 6s. per week and in the case of horsemen 10s. per week to cover employment, other than overtime employment, in excess of those hours. In the case of shepherds certain payments have also to be made in respect of the lambing season. The overtime rates for male workers of 21 years of age and over are 9d. per hour except on Saturdays, when the rate is 10½d. per hour, and on Sundays, when the rate is 1s. 1½d. per hour. In the case of female workers of 15 years of age and over the minimum rate is 6d. per hour for all time worked.

Somersetshire.—An Order to come into operation on October 1, 1929, *i.e.*, the day following that on which the existing rates are due to expire, and to continue in operation until December 20, 1930. The minimum rate in the case of male workers of 21 years of age and over is 32s. per week of 32½ hours in the week in which Christmas Day and Boxing Day fall, 50 hours in any other week in winter, 42½ hours in the weeks in which Good Friday, Easter Monday and Whit Monday fall, and 52 hours in any other week in summer, with overtime at 9d. per hour except for employment on harvest work during the hay and corn harvests, when the

overtime rate is 10d. per hour. The minimum rate in the case of female workers of 21 years of age and over is 6d. per hour for all time worked.

Pembroke and Cardigan.—An Order to come into operation on October 1, 1929, i.e., the day following that on which the existing rates are due to expire, and to continue in operation until September 30, 1930. The minimum rate in the case of male workers of 21 years of age and over is 31s. per week of 52 hours in winter and 54 hours in summer with overtime at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for a day of 8 hours, with overtime at 6d. per hour on weekdays, 6½d. per hour for the first 3 hours of overtime employment on Sunday and 7½d. per hour for subsequent hours.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Enforcement of Minimum Rates of Wages.— During the month ending October 15, legal proceedings were instituted against eleven employers for failure to pay minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages			No. of workers in- volved	
		£	s.	d.	£	s.	d.	£	s.	d.		
Berks	.. Abingdon	..	5	0	0	—	—	9	12	0	1	
Devon	.. Ivybridge	..	2	0	0	—	—	38	14	3	2	
Hereford	.. Ledbury	..	3	3	0	—	—	30	2	0	1	
Lancs	.. Bury	..	—	—	—	Case dismissed			1			
Lancs	.. Ormskirk	..	0	10	0	—	—	11	1	0	1	
Lancs	.. Preston	..	—	—	—	Case dismissed			2			
Salop	.. Chirbury	..	2	0	0	—	—	32	0	0	2	
Yorks, N.R.	.. Redcar	..	*	—	—	2	2	0	12	0	0	1
Yorks, N.R.	.. South Bank	..	†	—	—	2	2	0	30	13	10	2
Yorks, W.R.	.. Sherburn	..	*	—	—	0	13	0	27	0	0	1
Denbigh	.. Overton-on-Dee	0	5	0	—	—	—	3	10	0	1	
		£12	18	0	£4	17	0	£194	13	1	15	

* Dismissed under Probation of Offenders Act.

† Proceedings were also taken against the defendant in this case under Section 9 (3) (d) of the Act (giving false information) and a fine of £5 was imposed.

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National Diploma in Dairying.—The thirty-fourth Annual Examination for the National Diploma in Dairying, and the first to be held by the newly-constituted National Dairy Examination Board, took place in September at the University and British Dairy Institute, Reading, for English and Welsh students; and at the Dairy School, Kilmarnock, for Scottish students. Ninety-seven candidates presented themselves (46 at Reading and 51 at Kilmarnock) and 53 candidates (30 from England and Wales and 23 from Scotland) gained the

Diploma. No candidate at either centre on this occasion reached the Honours standard.

The institutions in England and Wales concerned in the training of the successful candidates were: the University College of Wales, Aberystwyth; the University and British Dairy Institute, Reading; the Midland Agricultural and Dairy College, Sutton Bonington; Studley College, Warwickshire; the Lancashire County Council Dairy School, Hutton, Preston; and the East Anglian Institute of Agriculture, Chelmsford. All the successful candidates at the Scottish centre had been students at the Kilmarnock Dairy School.

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Foot-and-Mouth Disease.—Outbreaks have been confirmed at two fresh centres as follows: at Chardstock, Devon, on October 10; and at Chartham, Canterbury, on October 21. The usual restrictions were applied to an area of approximately 15 miles radius round the infected premises.

No further outbreaks having occurred in the Lanarkshire infected area, referred to in the October issue of this JOURNAL, the restrictions were withdrawn on October 18.

There have been 29 outbreaks since January 1 last, involving 12 counties and the slaughter of 801 cattle, 994 sheep, 1,018 pigs and 4 goats.

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APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Somerset : Mr. H. Burdett has been appointed Assistant Instructor in Poultry Keeping *vice* Mr. W. M. Gair.

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND AND WALES

Studley College, Warwickshire

Miss M. Gubbins has been appointed Assistant Lecturer and Instructress in Horticulture, *vice* Miss M. Richards, resigned.

Miss M. Carter, B.Sc., has been appointed Lecturer and Instructress in Poultry Husbandry, *vice* Miss M. Mann, N.D.P., resigned.

Miss U. Dowse, N.D.A., has been appointed Assistant Lecturer and Instructress in Poultry Husbandry, *vice* Miss M. Carter.

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NOTICES OF BOOKS

Agricultural Economics.—By James E. Boyle, Ph.D. Pp. ix+519. (London : The J. B. Lippincott Company. 1929. Price 12s. 6d. net.)

This book is primarily intended for the American student, and was originally published in 1921. The present is the third edition and has undergone some revision.

It is not so much a theoretical treatise on agricultural economics as a general introduction to the study of those many and various questions which enter into the business side of farming—land tenure, labour, marketing, insurance, and many others. The bulk of the work is based on American experience and data, and for this reason the book is only of general interest to the English student. Rather strangely, in a book coming from Cornell University, little information is given about the principles and methods of farm management

research, of which so much has been done at that centre. Some of the results of such work are, however, to be found scattered through the pages of the present volume. The book is on the whole well arranged and contains much useful information in regard to American agricultural conditions.

AI First Biology.—By Professor S. Mangham, M.A., and Professor W. Rae Sherriffs, M.A., D.Sc., F.L.S. Pp. viii+175. (London : Sidgwick & Jackson, Ltd. 1928. Price 2s. 6d.)

This handy little primer in the study of biology is intended for the assistance of young students. The authors rightly emphasize the importance of a knowledge of the fundamentals of biology, not only from the viewpoint of the personal gain in an enlarged range of interest, but also in its economic and sociological bearing on the future development of the Empire. The value of the book is enhanced by the inclusion of many good line drawings and diagrams. Scientific terms and nomenclature have been used with restraint, and where their use has been imperative they are clearly defined in simple language. The printing of these terms in heavy type is a novel and useful feature. Discretion has been exercised in the choice of material—the problem of what to omit is always a difficult one in a primer. An appendix gives practical hints on the collection and preservation of specimens. It is a little surprising that the authors should advocate the primitive method of killing butterflies by means of pressure between finger and thumb. This practice, even in the most skilful hands, has certain objectionable features, and the student who wishes to get the best results from his examination of the rhopalocera will be well advised to use the orthodox killing bottle. As the authors have seen fit to give illustrations of microscopes, a short description of the methods of slide-making might have been included. One may anticipate that the authors will be justified in hoping that their volume may be of great service in schools. A supplementary book, covering rather more advanced sections of the subject, is to follow.

Agricultural Education in the United States.—By Whitney H. Shepardson. Pp. viii+132. (London : Macmillan & Co., Ltd. New York : The Macmillan Company. 1929. Price 6s. net.)

In view of the enormous extension of agricultural education and research in the United States during the last fifty years, and the devotion of its teachers and workers, anything that will enlighten us as to the methods adopted and the reasons for such progress will surely be welcome. This little book by Mr. Shepardson is admittedly a study by a layman, a New York business man, who states that he "knows very little about education and nothing at all about practical agriculture." It was first written as a report for the General Education Board, the "somewhat unconventional idea" being that "a layman, without professional training and without institutional loyalties, might produce some useful ideas." The study emerged out of talks with educational and research authorities, visits to some twenty-five agricultural institutions, and a considerable amount of reading. The result is not only an interesting book, but one may say also an inspiration. Not often could a layman do so remarkably well.

After emphasizing the importance of agriculture to the State and calling attention to the difficult position of United States farming, Mr. Shepardson expresses the view that it is important that this serious problem "be considered before the interest aroused by the events of the past ten years dies out."

The author does not advocate a big back-to-the-land movement, by quoting from *The Deserted Village*; he recognizes the fact that a

smaller percentage of the population than ever is producing food for the rest; he sees that the United States may, in a few years, become a food-importing rather than a food-exporting country; he briefly refers to related problems; and he hopes that "some day men and women, trained in agricultural institutions, will play a decisive part in their solution."

Succeeding chapters are devoted to a history of agricultural education in the U.S.A., the colleges, the system and service, science and research, with rather special attention to botany and plant physiology. He regards the agricultural college as the nucleus of agricultural education, its chief duty being "to prepare men and women for responsible posts in agricultural research, teaching and extension"; he advocates the promotion of fundamental research in the field of natural sciences—particularly in those dealing with plants; he stresses the importance of plant physiology; and he urges "the harmonious co-operation of chemists, physicists and biologists in long research without pressure for practical results." Altogether a stimulating work.

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DECEMBER, 1929.

NOTES FOR THE MONTH

A CONFERENCE on the growth of winter food for livestock was held at the Rothamsted Experimental Station on November

15, 1929, the chair being taken by the
Winter Food Right Hon. Lord Clinton. The subject
for Livestock was introduced by Mr. J. G. Stewart
(Deputy Chief Inspector for Education,

of the Ministry), who stressed the desirability of feeding home-grown crops—grain, fodder crops and roots—with special attention to lucerne, kale and the improvement and use of grass. He thought it well to concentrate on such an area of arable as could be well done, and concluded by asking the question: "Has any farmer ever suffered from over-production of feeding stuffs?"

Mr. Harald Faber (Danish Agricultural Commissioner in London) gave an interesting account of the great improvement of root crops in Denmark since the middle of last century. He laid emphasis on the need for growing varieties containing the highest percentage of dry matter. The Danes devote much greater attention to swedes than to turnips, and they depend greatly on roots.

Dr. H. E. Annett (Waikato, New Zealand) directed attention to the fact that in parts of New Zealand the plough is almost given up. The dairy cows may be out all the year round; the intensive grazing of grassland is based rather on 14 plots than on 7 as in this country; and the making of silage in pit or trench silos is universal, as is machine milking. There seems to be no difficulty in converting grass 3in. high into good silage.

Mr. W. A. C. Carr read a paper prepared by himself and Mr. W. B. Mercer (Cheshire School of Agriculture). The paper gave a valuable account of the work at Reaseheath, and indicated in favour of home-grown feeding stuffs that the cost of these per cwt. of starch equivalent is lower than in the case of purchased concentrates.

Captain R. Stallard (Pershore) also believed in home-grown fodder crops, but whereas his land and type of farming cuts out turnips, he is a strong supporter of lucerne growing taking a definite and permanent place in the rotation. He finds brussels sprouts and savoys useful crops, the "waste" leaves and stems being particularly valuable for the cows.

Mr. W. Brunton (Yorkshire) dealt with the improvement of grassland, and discussed his farms, indicating how by using home-grown crops he saved £400 per annum.

Mr. W. O. Watt (Essex) stated that he does not grow roots, but banks on careful attention to his grassland, lucerne growing, clover and rye-grass, and vetch and oat mixture. He does his labour mainly by tractor.

Mr. T. C. Ward (Wellington, Salop) advocated an increase rather than a decrease in root growing, and was emphatic as to the value of sugar beet by-products.

Mr. J. R. Keeble (Essex border of Suffolk) also advocated roots, and his pivotal crop is sugar beet. He expressed the opinion that farmers in this country "do not make half enough use of lucerne," which he finds invaluable.

After an interesting discussion the proceedings terminated. A full account of the Conference will be published later through Messrs. Ernest Benn, Ltd.

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THE rapid growth of a form of husbandry which depends on the growing of crops under glass is a modern romance in agricultural production. Starting in Guernsey, the industry spread to the south coast of England near Worthing, and was later established in the Lea

Valley (Herts, Essex and Middlesex), from whence there is now a tendency to spread in suitable centres all over England. The first houses in the Lea Valley were probably built about the year 1880; others quickly followed, until at the present time there are approximately 14,000 acres, or nearly half the total glass in the United Kingdom, concentrated in this district. The intensive nature of this form of agricultural production can be illustrated by the following estimated particulars of requirements and output from the Lea Valley. The capital invested must exceed £3,000,000, the wages bill £500,000 per annum, the consumption of coal 150,000 tons per annum and of water 1,500,000,000 gallons. Output is mainly tomatoes, estimated at 35,000 tons per annum; cucumbers, 15,000 tons, and there are considerable areas devoted to grapes, roses, ferns, etc.

The vitality of the industry is further exemplified by the fact that the need for research was early recognized, resulting in research work being started with funds raised by the growers themselves. From this beginning there developed the now well-known Research Station at Cheshunt, which has done and is doing such valuable work for the whole industry.

A further singularly appropriate advance has recently been made by the establishment of a centre where those entering the industry, whether growers or workers, can receive practical and technical instruction to qualify them for the highly complex and specialized business of growing crops under glass. This centre has been established at the Hertfordshire Institute of Agriculture, where $1\frac{1}{2}$ acres of commercial glass-houses have been erected for the purpose. In this way an entirely new and welcome addition has been made to the scope of agricultural education. Already the enrolment of students and the wide interest taken in the scheme give promise that a real need is being fulfilled, while at the same time another example is provided of the complementary nature of research and education.

* * * * *

It is the general custom for merchants to send out pig food in returnable sacks. Attention has recently been drawn

Non-returnable Sacks

to the fact that there is a grave danger that infectious diseases like swine fever may be carried from farm to farm by means of these sacks. The danger could be avoided by the use of non-returnable sacks.

In the past this course has been out of the question because of the high cost of sacks. There are, however, now on the market paper bags which will hold about four bushels. Experiments which have been made by the Pig Research Department, Wye College, indicate that some of these are suitable for carrying pig food and quite satisfactory for use on the farm. The sacks tried were 4-ply, that is to say, made of four thicknesses of brown paper. The cost is somewhat high—320s. per 1,000, i.e., $3\frac{3}{4}$ d. each—but there are probably many who will consider their use justifiable, especially in districts where disease is prevalent.

Although it has not previously been suggested that sacks of this type should be used for agricultural produce, it may be pointed out that they have been used for some time in commerce, notably for cement.

SPEAKING at the 51st Annual Brewers' Exhibition and Market at the Agricultural Hall, on November 2, Mr. Noel Buxton, M.P., referred to several important developments of the National Mark Scheme for All-English agricultural products. The Mark, which had already been applied so successfully to apples and pears, eggs, tomatoes and cucumbers, All-English wheat flour and home-killed beef, would on December 1 be applied to malt products.

Describing the National Mark Malt Products scheme, the Minister said that statutory grades for malt extract and malt flour, drawn up with the active and sympathetic co-operation of the Association of Malt Products Manufacturers, would be prescribed, and the now well-known National Mark consisting of a map of England and Wales with a Union Jack in the centre, would be used as a distinguishing mark on the packages containing goods of a standard grade. There will be three kinds of malt extract, namely :—

- (1) All-English pharmaceutical malt extract—for sale in retail jars in the chemists' shops—with or without cod-liver oil ;
- (2) All-English' bakers' malt extract, of which there will be two sorts, that is, one for use in baking brown bread and the other for white bread ; and
- (3) All-English veterinary malt extract for feeding all kinds of livestock. This also may be sold with or without cod-liver oil.

Two grades of All-English malt flour will be recognized. In this case also the distinction depends on the use to which the bakers will subsequently put the flour. One grade is suitable for making brown bread and the other for white bread. A definite specification of quality is attached to each grade.

Mr. Buxton pointed out that it is very important that doctors, chemists, bakers and others should know with some precision the composition and quality of the malt extract or malt flour that they are using. He hoped, therefore, that the definition prescribed by the regulations would be of general all-round assistance and would lead to the All-English article being generally prescribed and used. As from the beginning of next month there should be a plentiful supply of National Mark Malt products on the market, and he felt justified in saying that if the scheme goes as well as he thought

it ought to go, it would mean an additional direct demand for the produce of 10,000 acres of English barley.

* * * * *

As announced in the issue of this JOURNAL for September, 1928, the Minister appointed a Departmental Committee "to

Report of the Committee on the Reconstruction of the Royal Veterinary College consider and report generally on the reconstruction of the Royal Veterinary College, and the probable cost; and in particular on the questions: What accommodation should be provided, having regard to the training to be given; whether that accommodation can and should be provided on the present site; if not, where the College should be transferred; and what arrangements should be made in respect of the Animal Pathology Research Institute now situated at the College, if it appears necessary to change the existing arrangements."

The report of the Committee has now been published,* and contains some striking statements regarding the present condition of the College, a complete scheme of rebuilding being adumbrated. The Committee state that, with the exception of one building which is of fairly recent date, the College is in a state of dilapidation and the work is being carried on under conditions which are a national disgrace. As regards finance, the College at the end of last year was virtually bankrupt, and the Governing Body were only able to carry on for the present session on a semi-official assurance from the Ministry that, if the College had to close its doors, the Government would be unlikely to refuse the financial assistance necessary to enable the Governors to discharge their obligations towards the students who had been accepted for training.

The Committee have examined all the factors for and against the transfer of the College elsewhere, either to a London or rural site, and have come to the decision first, that a city site is essential in view of the need of securing adequate clinical material for training purposes, and secondly, that the existing site offers many advantages and should be retained. A scheme of rebuilding, designed to embody all the requirements of a complete training in veterinary medicine and surgery, has been drawn up. The cost of carrying out this scheme is provisionally estimated at £300,000, including the cost of purchasing the

* *Report of the Departmental Committee on the Reconstruction of the Royal Veterinary College.* H.M. Stationery Office, price 1s. 4d. post free.

site. The new scheme would involve an addition to the maintenance charge of, roughly, £21,000 per annum, together with a sum of some £4,500 per annum and upwards to cover the cost of research in the professorial departments. The Committee also recommends a substantial addition to the Ministry's present grant to the Research Institute in Animal Pathology connected with the College, together with the purchase of a Field Station outside London for the purpose of carrying out research into the diseases of large animals.

It is stated that the Committee's proposals would, if adopted, meet the requirements for the post-graduate training of veterinary surgeons for the Colonial Veterinary Service.

The Committee have also considered the question of the government of the College and have made recommendations and proposals for the future in this direction. Executive responsibility, it is stated, should be in the hands of a small body of men, selected for their personal qualities and acquaintance with the needs of veterinary education.

The Committee comprised Professor Sir Charles J. Martin, C.M.G., M.B., D.Sc., F.R.S., F.R.C.P., Director of the Lister Institute of Preventive Medicine (Chairman); Dr. O. Charnock Bradley, M.D., D.Sc., M.R.C.V.S.; Lieut.-Col. Sir Merrik R. Burrell, Bart., C.B.E.; Mr. H. E. Dale, C.B.; Sir W. M. Fletcher, C.B., K.B.E., Sc.D., F.R.S.; Sir Ralph Jackson, M.R.C.V.S.; Professor J. Share Jones, D.V.Sc., M.Sc., F.R.C.V.S.; Sir E. Cooper Perry, M.D., F.R.C.P.; Major-General H. T. Sawyer, C.B., D.S.O., and Lieut.-Col. Sir Archibald Weigall, K.C.M.G.

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WITH the object of encouraging and assisting the production and marketing of genuine home-produced wild white clover seed, arrangements have been made by the Ministry, in co-operation with the National Farmers' Union, to organize a scheme for the inspection and certification of crops of this seed.

**English Wild
White Clover
Seed**

Owing to its longevity, its hardiness under adverse conditions of soil and climate, its high feeding value and its sward-forming qualities, genuine English wild white clover is of particular value to the farmer laying down land to permanent pasture, or leys of two or more years' duration. Ordinary white or "Dutch" clover, on the other hand, is a much shorter-lived and less robust plant, the use of which, broadly speaking, should be confined to rotations, or for sowing down

for grass leys of not more than two or three years' duration. It is clearly desirable, therefore, that the farmer wishing to sow English wild white clover should be able to obtain a supply of seed the origin and quality of which is beyond doubt.

For the purposes of the certification scheme, a Central Wild White Clover Committee is to be set up in London, and local committees will be formed in each county area where wild white clover seed is grown. Growers who wish to have their crops inspected and certified will be required to make application to their county committee. Where, on inspection, the pastures or crops prove satisfactory, the grower will be registered by the central committee as an "approved grower," and, subject to the results of a growing on test, he will be entitled to obtain an official certificate, the reference number of which may be used in connexion with subsequent sales. The official certificates will be issued for two grades of seed only, one for crops of genuine old pastures—*i.e.*, those which have been under grass for ten years or more—and the other for crops of once-grown indigenous wild white clover—*i.e.*, once grown from seed from genuine old pastures as defined above. An appropriate fee will be charged to cover the cost of inspection.

Inspections of pastures and crops will be started in 1930, and arrangements are being made to set up the county committees. Growers of wild white clover seed who are interested in this scheme are invited to apply for further particulars to the Secretary of their county Wild White Clover Committee, whose address will be c/o the County Branch of the National Farmers' Union, or to the Secretary of the Central Wild White Clover Committee at the headquarters of the National Farmers' Union, 45 Bedford Square, W.C. 1.

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At a meeting of the Council of the Central and Associated Chambers of Agriculture, held on November 5, the following resolution was passed: "That in view of

**Central Chamber
of Agriculture
and National
Mark Schemes**

the great importance to the home live-stock industry and to farmers of a successful outcome of the experiments now being carried out (a) in London for the grading and marking of home-killed beef, (b) throughout the country for the grading and marking of English flour, and in view also of the fact that both schemes depend for their success on adequate and continuous publicity,

this Council expresses the fervent hope that the Government, the Press and producers' and agriculturists' organizations generally will co-operate to that end."

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THE article at p. 838 was prepared by the Ministry for issue as a booklet by the Empire Marketing Board. It deals with the National Mark schemes which **The National Mark** are now in operation for eggs, fruit, flour, beef and malt products. The booklet was designed to explain in a concise and convenient form the main features of the schemes, and to show their advantages to all concerned—producer, distributor and consumer. It is an eight-page print, $7\frac{1}{4} \times 4\frac{1}{2}$ in., in a stiff brown cover bearing the National Mark in colour. Copies of the booklet ("The National Mark") may be obtained, free of charge, on application to the Empire Marketing Board, Westminster, London, S.W. 1.

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SPEAKING at the tenth Annual Meeting of the Yorkshire County Allotments Federation at Huddersfield on October 26, the Minister said that the allotment movement was deserving of every encouragement by individuals, by local authorities and by the State. He drew attention to the increase in importance of urban allotments during recent years, and said that whereas before the war only one-quarter of the area of allotments provided by public authorities was in urban districts, now the proportion is over one-half. In actual numbers urban allotment holders outnumbered the rural by over two to one. This interest of town dwellers in allotment cultivation was one aspect of the revolt against those features of nineteenth century industrialism which caused such misery to the workers. It was showing itself also in the public demand for open spaces, for better lighted and better ventilated houses, and in public interest in all outdoor recreations and activities.

It was true that some 300,000 allotments had disappeared since the war, owing to the withdrawal for building and other purposes of large areas of land pressed into use for food production during the national emergency, but a comparison with the pre-war position showed a great advance, especially in regard to land purchased by Local Authorities for allotments. The total amount of land owned and leased by Local Authorities in 1928 was 57,021 acres, as compared with 33,523

acres in 1914—an increase of 23,498 acres. There was, however, still a large unsatisfied demand, and the Minister said he felt sure that, in spite of the obvious difficulties of securing and retaining land for allotments in developed or rapidly developing areas, a great deal could be done, given the right spirit in all concerned. He appealed to local authorities to call allotment committees together at regular intervals and to see that all matters concerning allotments were referred to and discussed by them, and reminded them that under the Act of 1925 they were given the power to spend up to a 1d. rate on allotments. He could imagine no more worthy subject for expenditure, if it were necessary, to secure the provision of adequate facilities.

Referring to the position of the allotment movement in Yorkshire, the Minister said that one-ninth of all the allotments in England and Wales were situated in the three Ridings of Yorkshire, and of these five-sixths were in urban areas. He also referred in terms of high appreciation to the work of the Coalfields Distress Committee of the Society of Friends, under the inspiration of Mr. Robson, the Chairman of the Yorkshire County Allotments Federation, in helping allotment holders in the distressed coalfield areas.

In conclusion, the Minister said he was very glad to hear that there was every prospect in the near future of the two organizations which at present represented allotment holders in England and Wales, *viz.*, the National Union of Allotment Holders and the Allotments Organization Society, coming together to form one National Society. He congratulated all those who had taken part in bringing about this very satisfactory achievement, and said that he felt sure it would be a great source of strength to the movement when allotment holders could speak with one voice.

* * * * *

A STRIKING display of National Mark apples and pears was seen at the Imperial Fruit Show held at Birmingham from October 25 to November 2. Most of the

National Mark competitors in the various exhibition
Scheme for Apples classes for home-produced fruit were
and Pears National Mark packers, and, with few
 exceptions, they were the winners of the
 principal prizes. In the 50-box class for culinary apples, National Mark packers secured the first three prizes. In the 50-half-box class for dessert apples, the same result was obtained. Similarly, the leading exhibits in the classes for

pears were shown by National Mark packers. In all, about 1,000 packages, the equivalent of approximately 800 bushels of National Mark apples and pears, were on display, and at the close of the Show they were sold under National Mark labels to wholesale distributors for dispatch to various parts of the country.

From information gathered by the Ministry's Marketing Officers, it is obvious that there is a growing interest in the National Mark Scheme, and that increasing support is manifest on the part of fruit growers. A further encouraging sign is seen in the effects of the Scheme upon the standard of production generally. There is no doubt that growers, including many not at present packing under the National Mark, have been convinced of the commercial necessity for producing better quality fruit, and a definite improvement in this respect is noticeable since the inception of the National Mark Apple and Pear Scheme.

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**Advisory
Committee on
Co-operation
and Credit** THE Minister has appointed Mr. W. Leach, M.P., to be Chairman of the Advisory Committee on Co-operation and Credit, in succession to Mr. G. M. Gillett, M.P., who recently resigned the Chairmanship of the Committee on his appointment as Parliamentary Secretary to the Department of Overseas Trade.

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THE following note has been communicated by the Imperial Bureau of Animal Genetics, Edinburgh:—

**Voronoff's
Treatment** Stock-breeders who were interested in the Voronoff operation, will remember that the delegation which went out from this country to investigate Dr. Voronoff's own experiments in Algeria, reported that there was insufficient evidence to justify his claims.* Since then two French veterinarians, MM. H. Velu and L. Balozet (Laboratoire de Recherches, Service de l'Elevage, Casablanca, Morocco), who also inspected Dr. Voronoff's work, have been repeating his experiments on sheep.

Eleven pairs of young rams (first cross between Crau merino ewes and a Rambouillet merino ram) were chosen, the members of each pair being for the most part half-brothers, and were numbered by tattooing on the inside of the ear. Lot A were

*See this JOURNAL, Vol. XXXV, April, 1928, p. 2.

to be grafted by the Voronoff method, and Lot B to serve as "controls." The mean age of the two lots did not differ by more than three days, nor their weight by more than 108 grammes ($\frac{1}{10}$ of mean weight). Lot A received the testicular graft according to the Voronoff technique, and all survived the operation. They were kept in stalls for two or three days before and 15 days after the operation, and were then placed with the flock, as were the "controls." Thus both A and B received precisely the same treatment, except that Lot A were grafted. Thereafter each animal in each lot was weighed once a month. During the first seven months Lot A showed a slightly greater increase in weight than Lot B, though in both there was considerable individual variation. After those first seven months A drew and remained ahead of B in weight, but the mean difference was negligible. Similarly, there was no significant difference between the two lots in weight or quality of wool. The investigators therefore conclude—justly, in our opinion—that the successful results apparently achieved by Voronoff were really due to the fortuitous choice of superior animals, and that testicular grafting has no effect on weight or growth. For the purpose of studying whether the effects of the graft are inherited, the rams, both of A and B, were each isolated with a ewe. At the time we received their report* it was too early to expect any results from this part of the experiment; but, remembering the failure of all the many efforts to induce the inheritance of acquirement, it is scarcely to be expected that the graft will be any more successful.

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H.R.H. THE PRINCE OF WALES visited the Islington Abattoir on October 22 to see the methods used in the grading and marking of National Mark beef.

Grading and Marking of Beef

He was received by the Lord Mayor and the Minister of Agriculture. With much interest His Royal Highness watched the Ministry's graders at work and witnessed a demonstration of marking. He then marked a side of beef himself, and expressed the hope that butchers would take full advantage of the scheme, and that housewives would ask for National Mark beef and see that they obtained it. Most of the sides displayed were from grass-fed cattle from the Midlands.

The sides offered for grading from the commencement of

* Presented by the authors to the Director of the Bureau.

the scheme to November 9 were classified by the official graders as follows :—

LONDON				<i>Total sides of beef graded (quarters and pieces excluded)</i>
	<i>Select</i>	<i>Prime</i>	<i>Good</i>	
Week ended Nov. 9..	506	1,158	246	1,910
„ Nov. 2..	486	905	269	1,660
„ Oct. 26..	458	666	340	1,464
„ Oct. 19..	370	698	322	1,390
„ Oct. 12..	414	701	466	1,581
„ Oct. 5..	82	132	82	296

BIRKENHEAD				
<i>(Sides consigned to Smithfield Market, London)</i>				
Week ended				
Nov. 9..	—	145	49	194
„ Nov. 2..	—	211	81	292
„ Oct. 26..	—	126	101	227
„ Oct. 19..	2	184	103	289
„ Oct. 12..	125	239	288	652
„ Oct. 5..	6	22	12	40

The fall in the number of sides graded after the week ended October 12 was due to the cautiousness of the London retail meat traders in their purchases of marked beef. As the figures show, there has been an appreciable improvement in the number of sides graded in London in the week ended November 9.

The Department of Agriculture for Scotland commenced its complementary grading scheme on October 28 at some of the Scottish centres where beef is exported to London. All beef graded in Scotland is marked under two grades—“Select” and “Prime”—with a distinctive Scottish mark.

The English scheme was extended to Birmingham on November 16, when the first carcass of graded beef was marked by the Lord Mayor of that city. A very encouraging start was made, the supplies of beef offered for grading being unusually large and of excellent quality. The wholesale and retail trade in Birmingham is showing great keenness in co-operating, and already a large number of retail butchers have asked to be placed upon the Ministry's roll of retailers who will regularly stock supplies of National Mark beef.

THE BALANCE OF NATURE

J. ARTHUR THOMSON, M.A., LL.D.,

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THIS old-fashioned phrase, "the balance of nature," sums up many interesting facts which show that animate nature is well-adjusted to keep agoing, and that smoothly. Living creatures have been sojourning together on the earth and in the waters under the earth for so many hundreds of millions of years that they have become adjusted into a *system*, which has staying power, and is not always tumbling to pieces. Their numbers and their claims have attained to some degree of harmony; and though this is often disturbed locally or temporarily, there is an automatic tendency to get back to a viable balance.

On the Scandinavian tablelands there are large numbers of little rodents called Lemmings—like small editions of Guinea-pigs; and every four years or so (in the period since precise observations began) there is an over-population crisis. The lemmings, having outrun the means of subsistence, having, in fact, devoured all the vegetation, unite in companies and go on a march, from which there is no return. Large numbers are found drowned on the shores of the Baltic and the North Sea, and most of the trekkers come to grief in other ways. Yet after a couple of years things are once more as they were. The balance has been restored. Lemmings are still flourishing, but for some other types in the past such crises have proved too serious, and species have been exterminated. Yet even more striking is the tendency that things have to right themselves.

A Wave of Life.—In his *Naturalist in La Plata*, W. H. Hudson tells of the summer 1872–73, that it was rich in sunshine and showers, blossoms and wild bees. But the fine weather was also very favourable for mice, which devoured the bees in their nests, and became so numerous that one could scarcely walk anywhere without treading on them. Cats became wild hunters; dogs ate almost nothing but mice; foxes, weasels and opossums fared sumptuously; tyrant-birds, Guira cuckoos, and even fowls became mouse-eaters. Countless numbers of storks and short-eared owls came to assist at the bountiful feast. But the winter was one of continued drought; the herbage was consumed or turned to dust, and, with the disappearance of their food and cover, the mice ceased to be. The army of enemies, now retreating with discretion, cleared off the residue of mice so thoroughly that "in the spring of 1873 it was hard to find a survivor." The wave of life was

lost in the sand, and soon things were as though nothing had happened.

Plants and Animals.—What we wish to do in this article is to analyse and illustrate the ecological idea of the Balance of Nature. We naturally begin with the most fundamental relation, that between green plants and animals. Those who have tried will admit the difficulty of adjusting the balance of plants and animals in a self-contained aquarium which is not artificially aerated. At one time the plants get the upper hand and may so crowd the water that the animals have not room to move about. At another time, the animals get the upper hand, and by devouring all the plants leave the water so poor in oxygen and so abundant in carbon dioxide that they suffocate. In other cases the animals are poisoned by their own nitrogenous waste-products, which are normally absorbed and utilized by the green plants. Now the point is that these aquarium disasters are unusual in natural conditions.

The most fundamentally important vital process in the world is the photosynthesis effected by green plants. The plants utilize the energy of the red-orange-yellow rays of the sunlight to build up carbon dioxide and water into sugars and other carbon-compounds, at the same time liberating oxygen as an all-important by-product. The carbon-compounds made in the green leaves form the food of the plants themselves, and of all the animals that feed on plants. Even when the animal is a thoroughgoing carnivore, a few links in the nutritive chain bring us back to green plants. All flesh is eventually grass and all fish is eventually diatom. The green plant, whether grass or diatom, finds the raw materials of its food in carbon dioxide, water, and dissolved salts; and the synthesized nutritive compounds—carbohydrates, fats, and proteins—are abundant enough to sustain the animal world as well as the plants themselves. Locally and temporarily, as in plagues of voles or of locusts, the animals may devour all the available plants; but it is plain that this is a rare, not a normal, occurrence. On the whole, the nutritive balance is preserved.

Not less important, though less frequently realized, is the fact that green plants have made the oxygen of the air, on which animal life depends. The original atmosphere of the earth was rich in carbon dioxide and water vapour; it had also some nitrogen, but very little oxygen—the production of which was and continues to be to the credit of green plants.

The Living and the Dead.—Surprise has often been expressed at the fact that we do not usually see many dead

animals lying about. After storms the flat beach is sometimes strewn with sponges, zoophytes, jellyfishes, starfishes, sea-urchins, and molluscs which are thrown up in profusion by some peculiar combination of wind and wave, but on land it is very rarely that we see any analogue of this jetsam. We have known of two hundred small birds being gathered in one farm-yard after a night of very severe frost, but such an occurrence is so rare in North Temperate countries that we remember it all our life. Part of the reason for the rarity of dead animals is that so many creatures are devoured by others ; and another part of the reason is that there are numerous scavenger animals like sexton beetles and the larvæ of carrion flies which bury or do away with the dead bird or mammal. Deeper, however, is the rôle of Bacteria, which are of great assistance in securing the smooth working of Nature. A dead animal rots ; that is to say its tissues are broken down by bacteria and converted in course of time into salts, ammonia and water. What is restored to the soil may soon be absorbed by the roots of plants, and even the ammonia that steals off into the air may be re-captured and brought again into the service of life. Thus bacteria complete a wide circle ; they unite dead animal and living plant.

Nutritive Chains.—There are many illustrations of what may be called a nutritive balance between different kinds of animals. Thus gulls often eat fishes, and fishes often eat crustaceans, and crustaceans often depend on diatoms ; and some sort of balance must be sustained, year in and year out. A correlation has been convincingly worked out between the catch of mackerel, the abundance of the small crustaceans called Copepods, and the density of the marine population of microscopic Peridinid Infusorians, besides the still more minute Diatoms, which form a very important part of the stock of the sea-soup. If one link in the nutritive chain is weakened, say the Diatom link by lack of sunshine, the result may be felt at Billingsgate.

It is said that a pound of cod's flesh involves the cod's consumption of ten pounds of large whelk or buckie, and that a pound of this muscular Gasteropod demands for its construction ten pounds of sea-worms ; and that a pound of worms is in turn the re-incarnation of ten pounds of microscopic organisms or organic particles. Thus in eating a pound of cod's steak for dinner the hungry man is devouring a thousand pounds of transmogrified seadust ; and the world is full of these cycles of re-incarnation or re-embodiment. This illustrates the idea of

nutritive chains, which contribute essentially to the Balance of Nature.

This large biological idea of nutritive chains finds many illustrations that affect practical interests. Thus it has been noticed in some parts of Britain, *e.g.*, the "garden of Moray," that the habits of Herring Gulls have changed very much for the worse during the last generation. They have become less markedly fish-eaters and very hungrily vegetarian. They sit on the "stooks" in the harvest fields and gorge themselves with corn. They work up the rows of turnips, scooping out one after another, and pecking at more than they devour, thus opening the way to fungi and threadworms. How has this change come about? Part of the answer is that Herring Gulls have become much more numerous. This may be because the natural enemies of the young, such as Sea Eagle and Peregrine Falcon, have disappeared or become rare; or because the eggs are not collected by man so systematically as in former thriftier days; or because some measure of protection has been extended to the adult birds. If it be objected that there are plenty of fish in the sea for all the gulls, the answer is that gulls do not dive and are therefore restricted to fishes swimming near the surface. It is quite possible that around some parts of Britain there are not enough of these to meet the demands of the increased numbers of Herring Gulls. Hence the change of diet.

The sound Natural History objection to any rapid elimination of any type of animal is that it may result in a disastrous disturbance of a long-established balance. To some extent it is good sense to connect a plague of voles and the like with the destruction of the natural checks to their increase, such as hawks and owls, weasels and stoats. This is not the whole story, for climatic cycles have their influence⁴, but it is one factor in the mischief. And it cuts both ways, for it has been shown that the supply of fox skins in Hudson Bay Territory drops when the lemming population is much reduced by starvation or epidemic.

Carnivores and Rodents.—Of great importance in connexion with agriculture is the balance between small rodents and small carnivores. An upsetting of this spells disaster. The rabbits in Australia illustrate this tragically, for in the main the prodigious multiplication of those that were imported to the great Island Continent was due to the absence of the natural carnivorous checks. The same is true in regard to the calamitous increase of European sparrows in the United States, into which small numbers were imported on repeated occasions, in the

hope of countering the attacks of elmtree caterpillars. Whether natural checks are exterminated or were never present is immaterial; and the introduction of newcomers into a country where there are no adequate checks will have of course the same results as the elimination of the natural checks in the old country.

Everyone knows the instructive story of the introduction of the mongoose into Jamaica. There are in Africa and India several kinds of these energetic fearless carnivores, which serve a very useful purpose in checking the increase of small rodents and of snakes. To check the imported oriental rats, which have followed man like a shadow on all his voyages, the mongoose was introduced into Jamaica, where it did good service. It not only counteracted the rats, but it turned its attention effectively to the native "cane-rats," small murine rodents very destructive in the sugar plantations. Having finished with the rodents, the indefatigable carnivores, who had now multiplied considerably, began to attack the poultry and the young of ground-nesting birds. They also attacked certain lizards and snakes, and several species were exterminated. But both the birds and the reptiles had been playing a useful part in checking the multiplication of various injurious insects, which now began to increase to the great detriment of certain crops. Thus the cure began to evolve a new disease, and this particular case is but one out of many. Consequences are not single, but multiple.

Operating on Nature is like playing chess—one has to try to see the distant consequences of a move. Some years ago in the North of Scotland a price was put on the squirrel's head, because of the damage it did in eating off the tops of young forest-trees. But as the squirrels' heads came tumbling in, month after month, for two or three years, all with the forester's approbation, a cloud rose in the sky, just as with the mongoose in Jamaica, for there was an alarming increase in the numbers of wood-pigeons. And these birds are on the black list as far as agricultural interests are concerned. The connexion, far from obvious at first, is that squirrels, vegetarians though they be, are unable to resist the gustatory appeal of the young pigeons they see in the nests on the trees. So the fewer squirrels, the more wood-pigeons, and the worse for the farmer.

Birds and Insects.—Of all these natural checks the one that means most to man's interests is that between insectivorous birds and injurious insects. When we think of the legions of plant-bugs (*Rhynchota*), the hosts of hungry larvæ, such as

caterpillars, leather-jackets, wireworms, the minute Diptera like the Frit-Fly, the vegetarian beetles like cockchafers and weevils, besides sawflies and scale-insects, and the frankly destructive tribe of locusts, we realize that their increase is a continual menace to the kingdom of man, which, after all, depends as yet on green plants of the field. ' If the cloud of injurious insects should thicken for a few years, the consequences would be disastrous beyond telling. Local plagues, now of locusts and again of caterpillars, here of cotton boll weevils and there of *Phylloxera* in the vineyard, hint to us loudly that our whole economic system may be readily imperilled if the natural checks to the multiplication of injurious insects should cease.

Changeable weather puts an end to many insect-pests ; a few commit race-suicide by devouring all the food, but this is rarely possible with field-crops ; fortunately for man, insects are often against insects—lady-bird beetles against green-flies and ichneumons against caterpillars, and so on ; spiders, frogs, toads, lizards, and other animals do their bit ; but on the whole, what matters most is that there should be an abundance of insectivorous birds, for they form the most important of all checks to the multiplication of injurious insects. We do not ourselves believe that there are data for prophecy, but some naturalists of distinction have said that if our insectivorous birds were wiped out—and they are being continually menaced—our whole bionomic system would come to an end within six to ten years. Whether this is or is not a sound prediction, it is absolutely certain that every reduction of birds that feed on injurious insects means a loss to agriculture.

Flowers and their Insect Visitors.—No naturalist can have any antipathy to insects even when they puncture the farmer's and gardener's and colonist's inflated hopes. They are so intriguing, so subtle, so masterful—with as much right to live, if the phrase has any meaning, as any other creatures. They are fascinating, even when they are sinister. Many of them are directly beneficial to man, as silk and honey so well illustrate ; others, like ichneumon flies, are invaluable in checking pests ; but the insects that mean most to man are those which secure the cross-pollination of flowers. In search of nectar and pollen, so often advertised by brilliance and colour, by fragrance and form, many insects, such as bees, butterflies, and two-winged flies, visit flowers and unconsciously secure cross-pollination. Without pollination the possible seeds or ovules cannot in ordinary cases become real seeds that will germinate ; and cross-pollina-

tion tends to secure not only more seeds but a better quality. Thus one of the most important instances of the Balance of Nature is that between flowering-plants and their insect-visitors. This is not affected by the fact that some of the plants that are most valuable to man, such as cereals, are pollinated by the wind-borne pollen-grains.

We have said enough to illustrate the biological idea of the Balance of Nature. Different kinds of living creatures have evolved together and become mutually dependent, so that increase or decrease on one side of the correlation inevitably affects the other. This is of great practical importance, warning man against upsetting what has been long established and automatically adjusted in Nature. The destruction of insectivorous birds means multiplication of injurious insects; the introduction of rabbits into a new country where their natural enemies are not represented leads to agricultural disaster; the careless introduction of weeds into new surroundings where they are not kept down has often been calamitous; even the apparently irreproachable destruction of poisonous snakes may be soon followed by a plague of small rodents which they helped to keep within bounds. Ignorance is usually very costly, and not least when it disturbs the Balance of Nature.

Man as Balancer.—But we must close with a more positive note, that man, with increasing knowledge, is learning to adjust a balance which he has helped to disturb. Thus, to take a well-known instance, he has been able to cope with the Australian Fluted Scale-insect (*Icerya purchasi*) which threatened at one time to put an end to the citrus trees in California. In 1888, Riley and his collaborators imported from Australia a ladybird beetle (*Novius cardinalis*) which is the native enemy of the Scale, and in less than eighteen months the conquest of the pest was assured. The Fluted Scale-insect has been practically exterminated in California, and the United States has sent the effective Ladybird to other Scale-infested countries, such as South Africa and Egypt, with happy results. *In hoc signo laboremus.*

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SOME CHANNELS OF AGRICULTURAL SCIENCE

[Being an address by Sir Charles Howell Thomas, K.C.B., C.M.G., Permanent Secretary to the Ministry of Agriculture and Fisheries, before the Cambridge University Agricultural Society on October 18, 1929.]

CAMBRIDGE University is one of the most important centres of agricultural science in the world. Here are Research Institutes in Animal Nutrition, Animal Diseases and Animal Breeding, in Plant Breeding and Horticulture. Here are departments carrying out investigations in agricultural economics, soils, general plant pathology and dairy bacteriology, and in such specialized subjects as virus diseases in potatoes and silver leaf disease of fruit trees. The work, in fact, ranges from the composition of the soil at six feet below the surface to the bacterial and fungal flora of the upper air. Then just outside the School of Agriculture is the Low Temperature Station for Research in Bio-chemistry and Bio-physics, and, opposite the University Farm, the National Institute of Agricultural Botany, for testing varieties of crops under the several soil and weather conditions of the different parts of the country.

Again, there are available, in the University, schools in many pure sciences allied to agriculture, whose co-operation can be secured and from which recruits for agricultural science can be drawn. When the additional facilities which the Rockefeller benefaction has made possible for agricultural and allied sciences become available, the position of the University in the agricultural scientific world should indeed be an enviable one.

The fact that the choice of the Rockefeller Trustees has fallen upon the University of Cambridge for the extension of these activities is indeed a matter of congratulation to all who are immediately concerned as a result of that choice.

It is fitting, therefore, that this opening address should be devoted to a consideration of certain aspects of agricultural scientific work. I have called my subject "Some Channels of Agricultural Science," and I want to refer, in the main, to two such channels, both leading from the agricultural scientist—the first to practical growers, and the second to fellow scientists. The first topic is the translation of scientific results into agricultural practice; the second is the linking up of workers in agricultural science throughout the British Empire.

The Channel from the Scientific Worker to the Practical Farmer.—"Book farmers" have been from time to time the subject of uncomplimentary remarks by practical farmers. The rival claims of theory and practice have been the subject of dispute throughout the ages—not only in agriculture, but generally. There is, however, only one opinion as to the merit of the combination of theory and practice.

In this connexion those of you who remember Amyot's French version of "Plutarch's Lives" will have in mind what he says on this subject in his Epistle to the Reader. North, in his great translation, after quoting Horace in this manner: "He which matcheth profit with delight, Doth winne the price in every poynt aright," refers to "booke knights" and "booke pilots" after quoting the argument that skill consisteth in action, and is engendered by the very experience and practice of things "when a man doth wel marke and thoroughly beare away the things that he hath scene with his eyes and found true by proof." According to the saying of the ancient poet Afranius:—

"My name is skill, my sire experience hyght,
And memorie bred and brought me forth to lyght."

You will also remember that he quotes the argument in certain things, *e.g.*, war, "the slights and policies that are to be learned out of bookes will serve the turne no more than mynes that are blowen up and that hearing of men talke and reason of paynting or the disputing upon colors, without taking of the pensill in hand" will not of itself make a good painter. This argument is preceded by the remark "it is not for a man to trust to the understanding which he hath gotten by reading in things that consiste in the deede doing where the hand is to be set to the worke." Amyot also warns him who would attain his end by only trial of experience, and advocates the combination of nature, art and practice.

This combination of Amyot's has been admirably put into operation in the Department of Agriculture at Cambridge, and has contributed in no small degree to the change in the attitude of farmers towards the work of the scientist which has so greatly facilitated the flow of knowledge along the channel from the laboratory to the farm. This flow has been greatly accelerated since the Great War—chiefly as the result of improved research organization. Before the war, the organization was generally weak: the problems that could be satisfactorily investigated were, therefore, few, and there

were but few research workers. Experiences of the war probably led to greater appreciation on the part of the British public of the value of research in general, and since the war the arrangements for agricultural research in this country, both national and local, have been fashioned into a most effective organization, reasonably well provided with funds and possessing a well-trained personnel. In consequence, the farmer finds that valuable assistance is available in all departments of his work, and he is in general anxious to obtain this assistance and utilize it to its fullest extent.

The co-ordination of advisory and educational work has kept pace with the growth of the research organization. There is also close contact nowadays between farmers' organizations and the research and educational organizations. Commercial bodies supplying materials such as feeding stuffs also make it their business to keep in close touch with research work and to pass on the results, in some cases maintaining their own special advisory organizations and even their own research workers. Lastly, the fact that an increasing number of farmers have been through an agricultural college or farm institute, and are more receptive and perhaps less conservative than the farmers of a generation ago, must also have some effect, especially as many of them constitute a centre of influence over neighbouring farmers.

We may now examine various parts of the channel between scientific work and the practical farmer. These are four—the research worker, the advisory officer, the county staff, the printed word.

(1) *The Research Worker*.—The research worker does not concern himself solely with the increase of knowledge: he generally assists also in spreading that knowledge. This may occur in more ways than one. Sometimes research institutes test out their results under local conditions and thus bring them to notice by direct means. Sometimes farmers and agricultural students visit a research institute, and the workers there are always willing to take the opportunity of spreading the results of scientific investigations. The researchers are not content, however, to remain shut up in their fastnesses and to await the assaults of those seeking wisdom. They issue from time to time from their laboratories and address meetings of farmers, which are in many cases arranged by the Ministry, the research institutes, the educational authorities, and the National Farmers' Union in co-operation.

(2) *The Advisory Officer*.—It is the function of this officer to translate science into practice. Thus he tests out the results of fundamental research under local conditions, and conducts research into local problems; and, what is perhaps even more important, he takes all possible steps to ensure that the results of research are made available for the farmers within his area, and that they are given advice on the problems confronting them in the conduct of their farming operations. Normally this advice would pass from the advisory officer to the farmer through the agricultural staff of the county, but it is often the case that direct contact is established between advisory officer and farmer.

Much of the advice is given by correspondence, but the officers are expected, whenever possible, to make personal visits, with a member of the county agricultural staff, in order to discuss conditions on the spot.

For the purposes of this advisory service the country has been divided into 14 areas, or provinces as we call them, with a centre at a University or an Agricultural College. The School of Agriculture at Cambridge is one such centre, and no fewer than 12 counties are included within its province. There are six classes of advisory officer: the chemist who would advise on soils, the entomologist, and the mycologist—whose work is co-ordinated by the Ministry's Plant Pathological Laboratory at Harpenden—the economist, the veterinarian and the dairy bacteriologist. Arrangements are made for securing effective co-operation between the advisory officers and the members of the county staff, and the closest touch is kept with research institute work.

(3) *The County Staff*.—In the Ministry's leaflet dealing with the provision of technical advice for farmers, the county staff is compared with the general medical practitioner, while the advisory officer is likened to the specialist. Perhaps the county staff could equally well be termed the storm troops of the advisory corps; they are in the first line of attack when inferior methods or lack of knowledge must be met, and they are the first to go over the top when farmers send out an S.O.S. To pursue this parallel, the county staff might be said to have behind them the general staff work of the Advisory Service who in turn rely upon the Headquarters activities of the Research Institutes.

The head of the county agricultural staff is the agricultural organizer, but some counties have an officer almost as important for horticultural questions, namely, the horticultural

superintendent. Then there are the county instructors in poultry keeping, dairying and many other subjects. Most of the county staff are in everyday contact with the farmer in various ways. There are more than 350 of these county officers—all "whole-time" officials—in England and Wales, while there are still others who give part-time instruction. Further, in many counties the staff connected with the farm institute render valuable aid in the dissemination of the results of research. County staffs and research workers are kept in touch with one another, first by conferences of agricultural organizers at which addresses are given on the most recent results of research work, and on the practical everyday difficulties of farmers, and secondly by an unofficial organization, the Agricultural Education Association.

(4) *The Printed Word.*—So far we have looked at the problem of technical advice almost entirely from the point of view of the spoken or written word. This is by far the most efficient method, since it is designed to meet the peculiar needs of the individual farmer. There is, however, a rôle to be filled by the printed word—by the distribution of journals, pamphlets and leaflets. The Ministry's JOURNAL presents practical information in non-technical language. Leaflets, written in a popular and practical style, are issued not only by the Ministry but also by many County Authorities, Colleges and Research Stations. They are increasingly used, not only by farmers but even by advisory officers who find in them a basis of advice for individual cases. The more ambitious publications of the Ministry—research monographs and economic reports—are more suitable for agricultural teachers and advisory officers than for the general farmer.

We have also taken advantage of wireless facilities. The Ministry is indebted to the B.B.C. for the facilities which enable it to deliver a fortnightly broadcasting talk on a variety of topical subjects, and whenever results of scientific research are available they are included. In addition, there are monthly talks by expert technical or scientific agriculturists on their particular subjects.

The Channel between Scientific Workers.—The second channel of agricultural science to which reference must be made is that between different research workers. The problem here is to secure that the most efficient use is made of the services of the research worker. This has assumed a new importance since the war, for there has been, throughout the world, a fuller realization of the services which agricultural

research can render. The consequence has been that governments have increased their expenditure on research services, with the result that many more workers are to-day investigating the problems of agriculture. Fundamental research in agricultural science, of course, knows nothing of national boundaries. The problems which confront the agriculturist in one country may be very much the same as those in another, and the results obtained by research workers in any one country may quite well be applicable in other countries. It is, therefore, of the utmost importance that research workers, in investigating their problems, should be fully seized of work done elsewhere on these and allied problems. Problems should, of course, be taken up at the stage at which they have been left by others, and for this purpose it is frequently necessary to gather together threads of different kinds. Research workers should be in the position to avoid the mistakes and profit by the experience of others.

Here, then, is an extremely good reason for world co-operation, and there has been a marked development in international organizations dealing with agricultural scientific work, as witness the activities of the International Institute of Agriculture at Rome.

If the argument for world co-operation is strong, that for co-operation within the British Empire is overwhelming. The germs of Empire co-operation in agricultural scientific work existed before 1914, but until this year the only organization designed for the purpose of collecting and disseminating information were the Imperial Bureaux of Entomology, Mycology, and Tropical Hygiene. In addition, of course, Kew Gardens and the Imperial Institute carried out Imperial work of a similar character, Kew fulfilling the functions of a bureau of botany and the Imperial Institute dealing with plant and animal products.

As is well known, an Imperial Agricultural Research Conference met in this country in 1927. That Conference dealt with many subjects with which we are not particularly concerned here, but one of its most important recommendations was the establishment of eight new Bureaux in agricultural science. That recommendation was adopted, and the Bureaux, which are to be administered by a central body representing the whole Empire, are being established and attached to research institutes. This arrangement ensures that the new Bureaux shall start under the best expert guidance, and the research atmosphere is obtained. One

Bureau, that for Plant Genetics (other than herbage plants), is being established at the plant breeding institute of the Cambridge School of Agriculture, under the direction of the distinguished Professor of Agricultural Botany, Sir Rowland Biffen.

The channel between agricultural research workers formed by these Bureaux should serve not only for the interchange of information; it should also facilitate the meeting and exchange of workers. The Bureaux ought thus to play a material part in securing the maximum efficiency of the research worker, wherever he may serve within the Empire.

There is one matter which may be mentioned, although it is not strictly relevant to the subject. If agricultural research is to be fully maintained it is of the first importance that an adequate supply of fully-qualified research workers should be available. It is not every honoursman in science who has the necessary gifts for research—who has what may be called the “research mind.” The recruitment of the services, therefore, calls for the utmost care. The research worker, after securing an honours degree in pure science, has usually devoted three years to post-graduate study and research on some particular agricultural problem before he commences his career as a fully-fledged research worker at the age of 26 or 27. Research workers in this country are largely recruited by means of the Ministry’s scholarship scheme, under which, on the average, a sum of almost £1,000 per man is spent on training after graduation to fit him for the post of research worker. The Ministry is very jealous of these workers when they embark on their career. It secures certain minimum rates of pay, increments, provision for superannuation and proper equipment.

The Imperial Agricultural Conference gave much consideration to the question of recruitment, and to the neglect of biological studies in the universities owing to the strong tendency among science students towards chemistry, physics and mathematics. As a result, universities and schools have been approached and a Committee of vice-chancellors of universities and head masters has been set up to examine the practical steps which can be taken to secure the development of the teaching of biology by co-operation between universities and secondary schools.

We are only at the beginning of an important movement towards close co-operation in agricultural scientific work within the British Empire. In one particular subject we

have had quite recently special consideration of Imperial questions. A few weeks ago, meteorologists from different parts of the Empire and workers in various agricultural sciences met in this country, for the first time, to consider the question of co-operation between the two different sets of workers, for the solution of the various problems in agricultural science in which the effect of climate and weather are concerned. One of the recommendations invited the Ministry to develop, on an Imperial basis, the work of collecting and disseminating information on the methods and results of agricultural meteorological research. The Ministry will do what lies in its power to implement this recommendation pending the further consideration of the whole subject by the next Imperial Agricultural Research Conference in 1932.

I hope I have succeeded in showing that the two channels of agricultural science dealt with are soundly constructed and are efficient for the purposes they have to fulfil. It is for the centres of agricultural learning, of which Cambridge is such a shining example, to make good use of these channels, and to ensure that the unimpeded flow through them shall ever increase in volume and quality, to the lasting benefit of agriculture, which is, in spite of the difficulties it is now experiencing, still one of our greatest industries.

Your aims and ambitions deserve every encouragement and if I have done anything to stimulate them I am happy and content.

If a scientific worker would deserve better of mankind he should bear in mind that :—

“ A happie wight is he that by mishappes
Of others doth beware of afterclappes.”

* * * * *

THE LONG ASHTON TAR-DISTILLATE WASH: FIELD EXPERIMENTS, 1929—II

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and

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PART I of this article appeared in the issue of this JOURNAL for September, 1929. It recorded the results obtained by experiments carried out with the Long Ashton tar-distillate wash, and gave a résumé of the results obtained up to the end of June in respect of leaf and young fruit markings by the Apple Capsid Bug (*Plesiocoris rugicollis*).

The results detailed in the present paper refer exclusively to the Apple Capsid Bug aspect of the problem, and show the concluding stages of the field experiments for 1929, including the figures relating to injury by the pest to the fully developed fruit.

Recapitulating briefly the results given in the previous paper, they showed that, in the case of Capsid Bug markings on trusses, infestations ranging from 13 to 93 per cent.—as shown by control (unsprayed) plots—were reduced to the merest traces by applications of the Long Ashton spray at 10 per cent. strength, except at one centre in Kent where the injury after spraying still amounted to 10 per cent. (The results at this centre have differed from all others throughout and are discussed later.)

In addition, the results from counts of Capsid Bug markings on fruitlets made at four centres (two in Worcester and one each in Gloucester and Devon) showed that percentage infestations, ranging from 55 to 90 per cent., were reduced by spraying to figures in no case greater than 6 per cent. It may be recalled that the field trials on apples were carried out at eleven widely-distributed centres.

Late frost damage, unfortunately, resulted in absence of fruit from three of these centres (Isle of Ely, Cambridge and Somerset). At another centre (Cornwall) fruit records were not dealt with because the attack of Capsid Bug there was extremely light. Owing to local factors which were found to have complicated the results at the Sussex centre, this is also omitted. At the remaining six centres both good crops of fruit and incidence of the pest rendered these trials a thorough test; it is with these centres alone, therefore, that the present article is concerned.

Methods of Estimation of Crop Damage.—The methods employed in obtaining the results here given were as follows :—

Eye estimations were omitted and all figures are the result of actual countings and weighings of the complete crop from trees. All counts were made by means of tally registers. Samples of 1,000 fruits were taken as the standard number, and the percentage figures given are the result of the counts of these samples.

In some instances, the entire crop on each plot was dealt with, but often it was necessary to restrict the fruit to that from a limited number of trees. In certain cases where there was a marked difference in the size of trees on any given plot adjustments were made in the number of trees from which the crop was picked in order to obtain cropping tree surfaces as nearly equal as possible. Further, this principle had to be applied to certain groups of control trees on which the crop was very light in order to get enough fruit for counting purposes.

The fruit was graded into two samples: those apples showing definite Capsid Bug injury, whether pronounced or slight only; and those entirely free. Such rigorous methods resulted in some perfectly marketable fruit being relegated to the former class, although the bulk of fruit in that class was, in most cases, definitely unsealable. Without such a rigorous grading no complete and reliable figures of Capsid Bug damage could have been obtained. The samples from each plot were weighed separately, after grading into the two classes mentioned, the total crop weights of the trees used thus being the sum of these two figures.

Strengths of the Washes.—The strengths employed for the three washes were as follows :—

Proprietary wash used as "standard" (S.): 10 per cent. strength.

Modification of Long Ashton Wash (Mod. L.A.): 10 and 6 per cent. strength.

Long Ashton Wash (L.A.): 10 and 6 per cent. strength.

The above information regarding strengths refers only to those centres dealt with in this paper.

Results.—All results given here refer, as already stated, to Capsid Bug markings on mature apples. No reference need be made to pests other than the Apple Capsid Bug, except that two photographs (Figs. 1 and 2) are included to show the satisfactory control of caterpillar obtained by the use of the Long Ashton spray at 6 per cent. strength, Capsid Bug also being so much reduced at that strength as to allow the vigorous shoot growth illustrated to take place.

The figures in brackets in column 2 of the tables following refer to the number of trees from which the crop was taken. With the exception of the table in the summary, all percentages are worked out to the nearest whole number.

CENTRE II.—CROPTHORNE, WORCESTERSHIRE

Dates of application of washes* : January 17, February 22, 1929

Date of final examination : September 27, 1929

Variety	Treatment		Percentage number of fruits marked by Capsid Bug Per cent.	Weight of fruit marked by Capsid Bug lb.	Weight of fruit unmarked by Capsid Bug lb.
Lane's	Control	(9)	90	88	10
Prince	10 per cent. S.	(4)	87	112	27
Albert	10 per cent. Mod. L.A.	(5)	52	73	104
	10 per cent. L.A.	(6)	11	18	106
	6 per cent. Mod. L.A.	(5)	82	46	33
	6 per cent. L.A.	(5)	45	177	233

CENTRE III.—HAMPTON, WORCESTERSHIRE

Dates of application of washes : February 11, February 22, 1929

Date of final examination : September 26, 1929

Variety	Treatment		Percentage number of fruits marked by Capsid Bug Per cent.	Weight of fruit marked by Capsid Bug lb.	Weight of fruit unmarked by Capsid Bug lb.
Prince's	Control	(2)	90	36	5
Pippin	10 per cent. L.A.	(4)	8	27	266
	6 per cent. L.A.	(3)	51	47	60
Lane's	Control	(6)	70	71	34
Prince	10 per cent. S.	(6)	74	55	32
Albert	10 per cent. Mod. L.A.	(6)	14	10	51
	6 per cent. Mod. L.A.	(6)	59	100	66

* The reason for two separate dates being given for the application of the washes is due to the fact that certain difficulties arose in connexion with the application of the washes, as stated in the previous article. The numbers appended to the experimental centres are the same as in the previous article.

CENTRE IV.—NEWNHAM, GLOUCESTERSHIRE

Dates of application of washes : February 4 and 5, 1929

Date of final examination : September 30, 1929

Variety	Treatment		Percentage number of fruits marked by Capsid Bug Per cent.	Weight of fruit marked by Capsid Bug lb.	Weight of fruit unmarked by Capsid Bug lb.
King	Control	(12)	60	24	25
Edward	10 per cent. S.	(12)	75	73	28
VII	10 per cent. Mod. L.A.	(8)	24	62	230
	10 per cent. L.A.	(8)	11	29	240



FIG. 1.—Portion of tree on Control Plot (Variety King Edward) at Centre IV (Newdale, Glos.). Showing severe caterpillar attack which, in conjunction with Capsid Bug damage, has resulted in poor shoot growth. Photographed July 5, 1929.



FIG. 2.—Portion of tree of same variety as in Fig. 1 on plot sprayed with the Long Ashon spray at 6 per cent strength, showing vigorous shoot growth and freedom from injury. Photographed July 5, 1929 at same Centre as Fig. 1.



FIG. 3.—Pippin tree, unsprayed and adjoining that shown in Fig. 4. Note severe Capsid Bug injury to fruit. Photographed September 26, 1929, at Centre Hill, Hampton, Wores.



FIG. 4.—Pippin tree, sprayed with the Long Ashton spray at 10 per cent strength, adjoining that shown in Fig. 3. Photographed on the same day.

The caterpillar attack on the control trees at this centre was very severe, as shown (Fig. 1), and one of the results of this, coupled with severe Capsid Bug damage, resulted in very light crops on the unsprayed trees.

CENTRE V.—TOPSHAM, DEVONSHIRE

Date of application of washes : February 8, 1929

Date of final examination : September 23, 1929

Variety	Treatment	Percentage number of fruits marked by Capsid Bug Per cent.	Weight of fruit marked by Capsid Bug lb.	Weight of fruit unmarked by Capsid Bug lb.
Lane's	Control (4)	65	270	160
Prince	10 per cent. S. (4)	36	100	270
Albert	10 per cent. Mod. L.A. (8)	11	10	130
	10 per cent. L.A. (4)	2	10	470

It should be noted, in relation to the above table, that the crop was taken from eight trees in the case of those sprayed with Modified Long Ashton spray at 10 per cent. strength. This was done in an attempt to compensate for the small size of the trees.

CENTRE VII.—CROCKENHILL, KENT

Date of application of washes : March 8, 1929

Date of final examination : September 17, 1929

Variety	Treatment	Percentage number of fruits marked by Capsid Bug Per cent.	Weight of fruit marked by Capsid Bug lb.	Weight of fruit unmarked by Capsid Bug lb.
Bismarck	Control (6)	64	214	159
	10 per cent. Mod. L.A. (6)	8	25	320
	10 per cent. L.A. (6)	3	9	377
Lord	Control (6)	76	184	56
Derby	10 per cent. S. (6)	95	337	31
	10 per cent. Mod. L.A. (6)	30	233	170

We are indebted to Mr. M. D. Austin, of the South-Eastern Agricultural College, for kindly furnishing us with the following figures relating to the grading and weighing of the fruit from trees of the variety "Allington Pippin" at this centre. Only weights were taken, no counts being made. We have accordingly set out below a separate table dealing with the above-mentioned figures.

Variety	Treatment		Percentage weight of fruit marked by Capsid Bug Per cent.	Weight of fruit marked by Capsid Bug lb.	Weight of fruit unmarked by Capsid Bug lb.
Allington Pippin	Control	Row 1 (3)	28	102	258
	Control	Row 2 (3)	50	161	159
	10 per cent. L.A.	Row 1 (3)	9	34	350
	10 per cent. L.A.	Row 2 (3)	11	60	497

CENTRE VIII. --WILMINGTON, KENT

Date of application of washes : March 9, 1929

Date of final examination : September 18, 1929

Variety	Treatment		Percentage number of fruits marked by Capsid Bug Per cent.	Weight of fruit marked by Capsid Bug lb.	Weight of fruit unmarked by Capsid Bug lb.
Lord Derby	Control	(6)	100	126	0
	10 per cent. S.	(4)	83	200	12
	10 per cent. Mod. L.A.	(6)	65	288	159
	10 per cent. L.A.	(6)	97	447	40
Grenadier	Control	(6)	57		
	10 per cent. S.	(6)	49		
	10 per cent. Mod. L.A.	(6)	33		
	10 per cent. L.A.	(6)	37		

It will be observed that no weights were taken in connexion with the fruit of the variety "Grenadier" at this centre. For the count of the fruit of this variety thanks are due to the grower at this centre.

It has already been stated that, of the eight centres where the Long Ashton wash was applied, this centre was the only one where leaf damage by Capsid Bug exceeded "trace" on the sprayed trees. It was subsequently reported, during the young fruit period, that Capsid Bug injury had continued to increase on all the plots. At the final examination this was borne out, as will be seen from the figures given above. The best control of Capsid Bug was on the Modified Long Ashton wash plot, this being the only instance throughout the whole of the trials where the Long Ashton wash failed to give the best result. It will be further observed that, in the case of all the washes used at this centre, the pest damage figures are very considerably higher than those at any other centre. This abnormal result would suggest that some special local

circumstance was responsible for the deviation from the other trial centres, and it is, therefore, proposed to make a special investigation at this centre next year.

Relation between the Time of Application of the Spray and the Control of Capsid Bug.—It has been observed in the past that a greater degree of control of Capsid Bug* was obtained when the tar-distillate washes of the ordinary type were applied near to the time of hatching of the eggs. It will be observed from the information given in this and previous papers that the results obtained by the use of the Long Ashton wash were as effective in the case of early applications of the wash as in those instances when it was applied late.

As an explanation of this, Mr. F. Tutin, as a result of unpublished experiments, makes the following suggestion :—

The time that the eggs are most easily killed is shortly before the normal hatching period. The older commercial types of tar-distillate wash in use contain tar-acids and, in addition, a considerable proportion of low-boiling material. The tar-acids are washed out by rain, and the low-boiling material evaporates, with the result that there may remain only about 30 per cent. of the original material present on the tree at the time when the eggs become susceptible to killing, if the wash was applied early in the dormant season. The Long Ashton wash contains no tar-acids, and the material boils above 280° C. and is relatively non-volatile, thereby ensuring that the major portion of the oil remains upon the trees until the eggs are killed.

The Long Ashton wash may, therefore, probably be applied at any time throughout the dormant season without any serious risk of loss of efficiency.

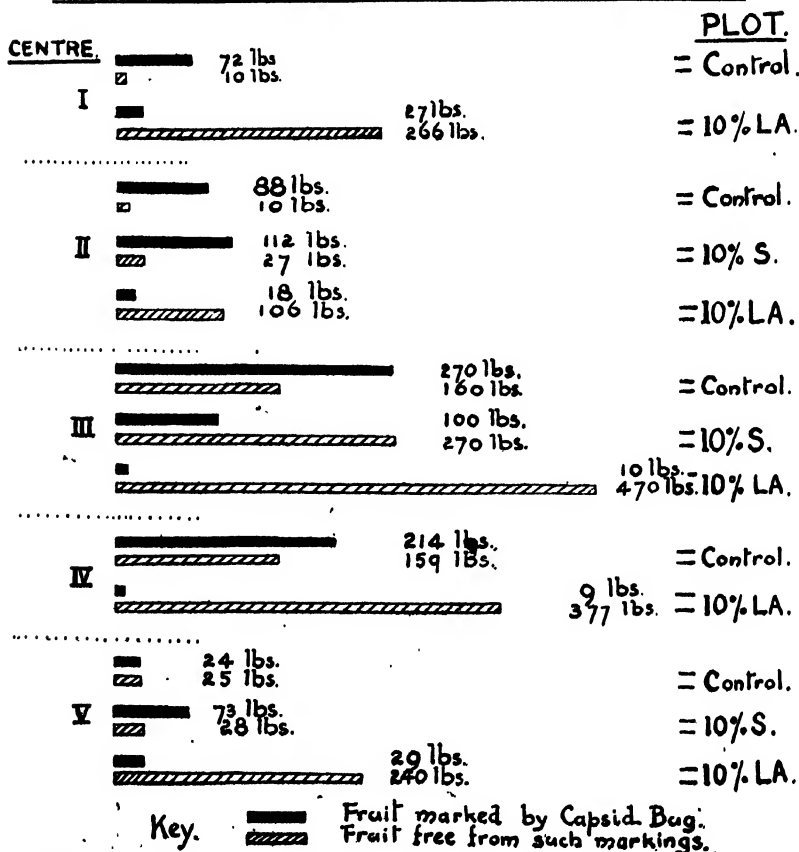
Summary of Results.—The outstanding features of the information and tables already dealt with are set out in graphic form in the diagram overleaf.

The salient points are (a) the great reduction by the use of the Long Ashton wash at 10 per cent. strength in the amount of fruit marked by Capsid Bug as compared with the unsprayed trees and those sprayed with a commercial wash of the old type at the same strength; and (b) the increase in weight of clean fruit as well as total weight of crop, which was a noticeable feature in several instances.

The following table gives the percentage injury and percentage weights for the three centres where all the washes were applied on the same variety of apple at each respective centre and where, therefore, the results obtained are specially suitable for the compilation of such a table.

* This remark applies also to other pests such as aphids, apple sucker and caterpillars, but particularly to Capsid Bug, the egg of which is much more difficult to kill.

Treatment	Average percentage number of fruits marked by Capsid Bug Per cent.	Total weight of fruit marked by Capsid Bug lb.	Total weight of fruit unmarked by Capsid Bug lb.	Total weight of fruit (marked and unmarked) lb.	Average percentage weight of fruit marked by Capsid Bug Per cent.
Control	71.6	382	195	577	66.2
10 per cent. S.	65.3	285	325	610	46.7
10 per cent. Mod. L.A.	29.0	165	724	889	18.5
10 per cent. L.A.	8.0	57	816	873	6.5



DIAGRAM

Weights of fruit marked by Capsid Bug and fruit free from such markings, from five centres. The weights are shown graphically and to scale and indicate the condition of the fruit on (1) unsprayed trees (2) those sprayed with an ordinary commercial tar-oil wash at 10 per cent. strength and (3) those sprayed with the Long Ashton spray at the same strength.

Note the increases in total weight of fruit as well as in the percentage of clean fruit.

S = Proprietary wash used as "standard."

Mod. L.A. = Modification of Long Ashton wash.

L.A. = Long Ashton wash.

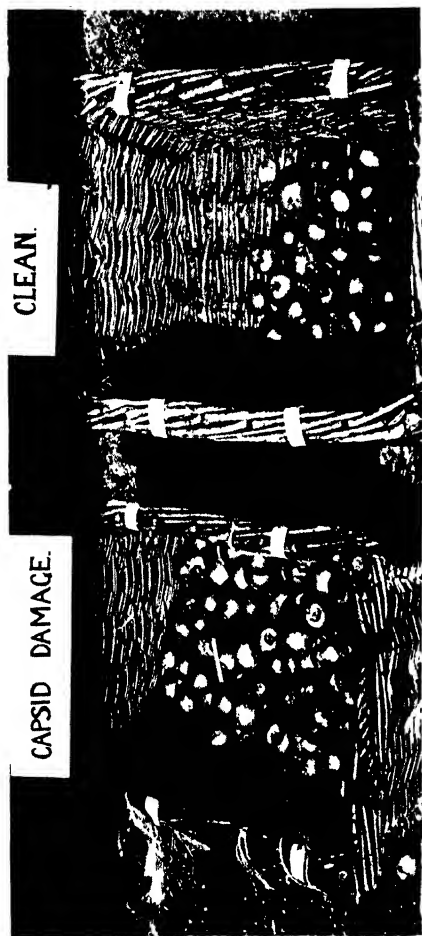


FIG. 5. Total fruit picked from *two* Prince's Pippin trees unsprayed. The fruit has been graded as labelled. Photograph taken at Centre III, Hampton, Wores, September 26, 1929.

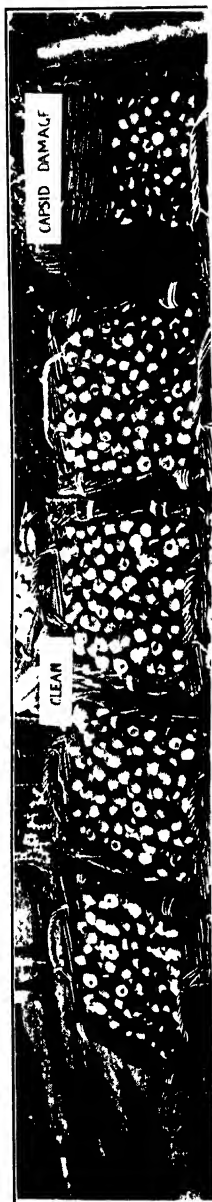


FIG. 6. Total fruit picked from *four* Prince's Pippin trees, sprayed with the Long Ashton Spray at 10 per cent. strength. The fruit has been graded as labelled. Photographed at Centre III, Hampton, Wores, September 26, 1929.

It is thus evident that the statement made in the previous article in this JOURNAL for September last, namely, "that the Long Ashton spray at 10 per cent. strength gave a consistent control of Capsid Bug of such a high order that further spraying in the spring for this pest was rendered unnecessary" is fully justified as a general rule.

Recommendations.—The following recommendations made in the previous article, with reference to the spraying of apples, can only be repeated.

- (1) Where trees are infested with Capsid Bugs, the wash at 10 per cent. strength during the dormant season (December, January or February) should be used.
- (2) Where Capsid Bugs are absent, the wash at 6 per cent. strength should be used.

Acknowledgments.—It may be recalled that the cost of these extensive trials has been met by a special grant from the Ministry of Agriculture. The writers have again to acknowledge further assistance by Advisory Officers, County Staffs, growers and others, and also desire to express their indebtedness to Mr. F. Tutin for his constant help and advice throughout the progress of the work. Mr. G. H. Jones, of the Long Ashton Station, is responsible for the excellent photographs reproduced as illustrations to this and the previous (September) article.

ARTICLES ALREADY PUBLISHED RELATING TO THE LONG ASHTON TAR-DISTILLATE WASH

- | | | |
|--|--------|---|
| (1) Smith, L. E. | (1926) | "Investigations on Tar-Distillate Sprays."
Ann. Rept. Agric. and Hort. Res. Stat., Long Ashton. |
| (2) Tutin, F. | (1928) | "Investigations on Tar-Distillate and other Spray Liquids: I.—Improvements in the Methods of Preparation of Tar-Distillate Spray Fluids."
Ann. Rept. Agric. and Hort. Res. Stat., Long Ashton. |
| (3) Staniland, L. N., and
Walton, C. L. | (1928) | "The Long Ashton Tar-Distillate Wash: Field Experiments, 1927-28."
This JOURNAL, Nov., p. 731. |
| (4) Staniland, L. N., and
Walton, C. L. | (1929) | "The Long Ashton Tar-Distillate Wash: Field Experiments, 1929."
This JOURNAL, Sept., p. 517. |

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DEVELOPMENT OF AGRICULTURAL EDUCATION

THE following Circular Letter, dated November 7, 1929, has been sent by the Ministry to County Authorities for Agricultural Education in England :—

SIR,—His Majesty's Government have recently had under consideration the system of agricultural education conducted by Local Authorities.

They believe that that system has done and can do much for the general benefit of agriculture throughout the country : and they are anxious that it should continue to grow in scope and efficiency. They are accordingly prepared to support by the provision of additional funds a reasonable expansion of the present work and organization : and the Ministry is authorized to inform you that within due limits it will be prepared to aid, on the existing scale of grants, such developments as may commend themselves to your Authority and may receive the Department's approval. I am accordingly to ask that at an early date your Authority will review the schemes of agricultural education now operating within its area, examine carefully any faults or deficiencies that there may be, and submit proposals for remedying them so far as practicable.

In dealing with this important subject, your Authority may find it useful to have a brief indication of some directions in which the Ministry thinks that many County schemes of agricultural education might profitably be extended. It ventures to suggest, therefore, that your Authority should consider the work, if any, which is already done within its area in the following directions, and whether the initiation or further development of such work could not be profitably undertaken :—

(1) The provision of technical advice for farmers both generally and in comparatively specialized branches, such as dairying, poultry-keeping and horticulture.

(2) The provision of organized day classes and evening classes in agricultural subjects at local centres, for the younger generation both of farmers and of agricultural workers.

(3) The organization of classes, in agriculture and general subjects, for boys and girls in the intermediate stage between school-leaving age and the age at which applied agricultural instruction can most usefully be given (see Circular Letter of March 22, 1927, from the Ministry

and the Board of Education). In planning courses of this kind, Authorities would no doubt have regard to developments likely to follow from the raising of the school-leaving age.

(4) The agricultural education of women and girls, on the lines of the Report of Lady Denman's Committee on the Practical Education of Women for Rural Life.

(5) An increase in scholarships (including maintenance allowances) at farm institutes and institutions of higher agricultural education, designed to secure that no really suitable candidate is precluded by lack of means from attending courses to which he or she is suited.

(6) The organization of agricultural discussion societies among farmers.

(7) Technical assistance for Young Farmers' Clubs, in co-operation with the local representatives of the National Council of Social Service.

The Ministry does not suggest that this list is exhaustive ; it realizes that in particular Counties there may be other schemes which could be undertaken with equal benefit to the agricultural community. It thinks, however, that in many counties developments on some or all of the lines indicated deserve the serious consideration of the Authority.

Again, the Ministry is well aware that in most Counties the existing staff is already fully employed, and that it is impossible to contemplate any real expansion of work without the appointment of additional officers. It is obviously useless to consider schemes unless there is or will be provided a staff to carry them out. If your Authority should contemplate any appreciable development in the important and pressing matter of the agricultural education of women and girls, it would no doubt consider whether one member at least of any additional staff required ought not to be a woman. Furthermore, a large increase of work and of staff will involve for the head of that staff additional responsibilities which, in proper cases, may not unreasonably be recognized by an increase of salary.

I am to ask that your Authority will consider this letter and submit as soon as possible such proposals for developing agricultural education in the County as may appear to be required. Financial provision for such proposals should be made in your Authority's Estimates for the year beginning April 1 next ; but the Department would be glad to receive, in advance of the submission of the usual Estimates and in any case before

the end of January next, particulars of the proposals and of their estimated cost.

The Ministry has thought it unnecessary to dwell in this letter on the benefits which the numerous activities included under the general name of agricultural education can offer, both to those now engaged in agriculture and to the rising generation with whom rests the future of the industry. It trusts that on that point your Authority does not require to be convinced; and it earnestly hopes that the Authority, recognizing that (with aid available from the Exchequer on a not ungenerous scale) much may be done for local agriculture at comparatively little cost to the County, will be willing and eager to co-operate in strengthening and extending the present organization.

In conclusion, I am to say that the Ministry will be happy to give, through its local staff or otherwise, any advice or assistance in its power to your Authority in considering possible new developments and in working them out.

I am, etc.,

CHARLES J. H. THOMAS.

[A Circular letter in similar terms was sent by the Welsh Department of the Ministry to County Authorities responsible for Agricultural Education in Wales and Monmouthshire on November 8, 1929.]

* * * * *

THE NATIONAL MARK

The Problem.—The farms of England and Wales cannot feed our whole population, but they can and do produce vast quantities of produce which is superior to imported produce by reason of quality, flavour, freshness and, frequently, nourishment—and they might produce more if it could be sold. On the other hand, there is a widespread public preference for home produce which remains unsatisfied because of the inability to identify or to obtain home produce in markets and shops. So there are willing producers and willing purchasers and the problem is simply how to bring them together.

The Solution.—The problem is one of marketing, so also is the solution. First of all, home produce had to be given standards of quality called grades, and then this graded produce had to be given a mark by which it could be identified. In order to make buying easy, one mark, the National Mark, is being or will be used for all graded produce of England and Wales, and, in order to give confidence to buyers, this

mark conveys, by law, a guarantee that the quality of the produce is of the grade stated.

NATIONAL MARK PRODUCE NOW OBTAINABLE

Apples and Pears.—There are three grades of quality for apples and three for pears, size, colour and blemish being taken into account. The grades are called *Extra Fancy*, *Fancy* and *C*, the packages bearing blue, red and yellow National Mark labels respectively. All National Mark apples and pears must be properly ripe and not over-ripe and no blemish is allowed that will affect keeping quality.

The packer is bound to state on the label of the package the variety of the apple or pear, his own name or identification mark, the grade, the date of packing, and either the weight or the number of the contents. The label thus gives the purchaser all the information required, and it is not even necessary for him to see the contents of an unopened package. The flavour of an English apple or pear has always been incomparable; by buying National Mark apples and pears (dessert or cooking) the public can be sure of getting the flavour together with reliable quality.

Tomatoes and Cucumbers.—There is only one quality of National Mark tomatoes and cucumbers (because it is easier to prevent blemish on these than on apples and pears), and the grade differences relate only to size. The quality grade is justly called *A.1.* A blue National Mark label is used on which must be stated the name or other identification mark of the grower, the net weight of the package and the size range of the contents. Home-grown tomatoes and cucumbers are superior in flavour to imported fruit.

Eggs.—There is, of course, only one quality for National Mark eggs, all of which are most carefully tested for freshness. There are three weight grades for hen eggs and three for duck eggs :—

SPECIAL (Blue label), minimum weight of each egg $2\frac{1}{2}$ oz.

STANDARD (Red label), minimum weight of each egg 2 oz.

PULLET STANDARD (Yellow label), minimum weight of each egg $1\frac{1}{2}$ oz.

SPECIAL (DUCK) (Blue label), minimum weight of each egg $2\frac{1}{2}$ oz.

STANDARD (DUCK) (Red label), minimum weight of each egg $2\frac{1}{2}$ oz.

DUCKLET STANDARD (Yellow label), minimum weight of each egg $2\frac{1}{2}$ oz.

National Mark eggs can be bought loose or in small cartons, each holding 6 or 12 eggs, sealed with the National Mark label. The public are reminded that the National Mark

appears on the package and never on the egg, whereas the source of *imported* eggs must be stamped on each egg itself.

Flour.—There are three grades of National Mark flour made entirely from home-grown wheat :—

ALL-ENGLISH (PLAIN)

ALL-ENGLISH (SELF-RAISING)

ALL-ENGLISH (YEOMAN)

Apart from certain constituents added to All-English (Self-raising) in order to make the flour rise, National Mark flour of all grades is guaranteed to be pure and free from any added chemical substances. It preserves, therefore, the full characteristic colour and flavour of good, clean, home-grown wheat.

National Mark flour can be obtained in sacks by wholesale buyers, or in small packages, from 1 lb. upwards, for use in the home. Bakers and manufacturers will find All-English (Plain) flour specially suitable for biscuits and confectionery. On the other hand, bakers, or housewives who bake their bread at home, will find All-English (Yeoman) produces a really good tasty loaf. For household purposes, in making puddings, pies, cakes, pastry, etc., use All-English (Plain) or All-English (Self-raising).

The three grades are distinguishable by different coloured labels :—

All-English (Plain) *BLUE label*

All-English (Self-raising) *RED label*

All-English (Yeoman) *YELLOW label*

Beef.—Experimentally, but on a commercial scale, graded and marked home-killed beef came on sale this autumn in London and Birmingham.

There are three quality grades of home-killed beef : “Select,” “Prime” and “Good.”

“*Select*” grade carcasses are from young specially-fed animals, producing beef of particular tenderness.

“*Prime*” grade beef is also of exceptional quality but will provide rather larger joints.

“*Good*” grade beef is likely to be slightly leaner than either of the other two grades and on that account will probably be popular.

The National Mark on graded carcasses takes the form of a ribbon stamp, drawn down the whole of the side, the colouring matter used being flavourless and entirely harmless. The Mark shows on all the principal joints. It bears the grade name “Select,” “Prime” or “Good,” the words

"Home Killed" and a silhouette map of England and Wales. Only meat of high quality is graded.

Malt Products.—A scheme for applying the National Mark to malt flour and malt extract made entirely from home-grown grain came into operation on December 1, 1929.

There are two grades of malt flour, viz. :—

All-English Malt Flour (Brown Bread) for use in baking brown bread.

All-English Malt Flour (White Bread) for use in baking white bread.

These are sold in packages bearing a red label and blue label, respectively.

National Mark malt extract is of three kinds, namely :—

All-English (Pharmaceutical) Malt Extract, obtainable either in its pure state or mixed with cod-liver oil.

All-English (Bakers') Malt Extract—a pure extract for use in breadmaking.

All-English (Veterinary) Malt Extract, which may also be obtained either with or without the addition of cod-liver oil.

The purity and quality of National Mark malt products is guaranteed, including their diastatic power, i.e., the power of converting starch into sugars. This is of enormous importance to doctors and bakers who must have a reliable article of known strength.

All-English Pharmaceutical Malt Extract, either with or without cod-liver oil, is unequalled as a reliable aid to digestion or as a food for children.

As in the case of other commodities, different coloured labels are used to distinguish the grades; blue, red and yellow are the distinguishing colours for All-English Pharmaceutical, Bakers' and Veterinary Malt Extracts, respectively.

Future Schemes.—A wide range of home products will in time be brought under the National Mark. Already schemes are under discussion for poultry, canned fruits, soft fruits, cream and cider, and the limitation of the National Mark can only be measured by the limitations of home agriculture.

HOW THE NATIONAL MARK HELPS THE PRODUCER, THE DISTRIBUTOR AND THE CONSUMER

The vast and increasing population of our industrial centres cannot economically be fed by direct trade with the farmer. Mrs. A, living in a densely populated area, cannot buy her daily supplies of potatoes from Farmer B in Lincoln.

shire, and of butter from Farmer C in Devon, and of eggs from Farmer D in Hampshire. She must normally deal with her shopkeeper for these things. Similarly, her shopkeeper cannot arrange for individual farmers to supply him with all his daily requirements; he finds it more convenient to buy through the wholesale trade. Hence the wholesale trade now occupies a key position of great importance, and the farmer must rely on it largely to sell his produce in excess of local demands. Further, if he can increase his production, it is to or through the wholesale trade that he must sell the increase. Wholesale markets have a very large daily turnover and their whole existence depends on maintaining and increasing that turnover. Therefore, they are eager to receive that produce (from whatever part of the world) which arrives in regular supply and is of dependable quality, carrying a mark of known integrity and requiring the minimum of inspection by wholesaler or buyer.

The distributor, whether wholesaler or retailer, is, however, very conscious of a demand for home produce, and it is his business to supply what the public wants. He welcomes, therefore, any scheme which makes it easier for him to offer home produce for sale in a form which begets confidence and is attractive in competition with imports. Further, ungraded, badly-packed produce from whatever source means to the distributor wasted time and risk of loss of money and of customers. Well-packed, well-graded produce brings satisfaction to his customers, and reduces the element of speculation in his business.

This is the secret of the National Mark scheme, by which it is hoped to pass quickly into consumption increasing quantities of home-grown foodstuffs which might otherwise never reach the consumer's table. Assured of a regular market for his output, the farmer can concentrate on getting the utmost out of the land, to his advantage and not, as has sometimes happened in the past, to his cost.

The objectives of the National Mark are, therefore, stability in the industry and the general satisfaction of producer, distributor and consumer.

The National Mark scheme is not a device to exploit the public. The public benefits from regular supplies of home produce of guaranteed quality. The benefit to the farmer comes mainly through the ability to sell a larger output without "knocking the bottom out of the market." The benefit to the distributor is, broadly, through lower handling

costs, reduction of risks and through giving him a real chance to satisfy the public demand for home produce.

Agriculture is still the leading industry even in this intensely industrial country, and national interests require a prosperous agriculture with increased employment on the land. But it is as a symbol of mutual interest that the public are advised to support the National Mark—firstly, to help themselves, secondly, to help the nation, and thirdly, if any other reason is needed, to help the farmer. “*Empire buying begins at home.*”

* * * * * *

THE GRADING AND MARKING OF MALT FLOUR AND MALT EXTRACT MADE FROM HOME-GROWN GRAIN

DURING recent years, the demand for barley, other than for stock feeding, has been steadily declining in this country. In view of the excellent quality of the home-grown article, it is desirable, therefore, to make some effort to enable English barley in various forms to maintain or extend its position on the market in face of imported products or of products made here from imported grain.

It is the general opinion of the traders concerned that it would react to the advantage of barley growers in this country if standard grades of malt flour and malt extract, made wholly from home-grown grain, were defined and the products marked in some distinguishing fashion. With this end in view, a system of voluntary grading and marking under the Agricultural Produce (Grading and Marking) Act, 1928, has accordingly been instituted.

It is hoped that buyers desirous of obtaining a good and reliable article will regularly demand the standard home product bearing the National Mark of quality.

(1) **Grading.**—The Act referred to enables the Minister of Agriculture and Fisheries to make regulations prescribing grade designations for any kind of agricultural produce and defining the quality indicated by such designations. The Act provides that where any person sells an article of agricultural produce to which a grade designation is applied, then, notwithstanding any contract or notice to the contrary, it shall be deemed to be a term of the contract of sale that the quality of the article accords with the statutory definition of quality applicable to the grade designation.

Grade Designations and Definitions.—After consultation with the various interests concerned, grade designations and definitions of quality, as set out in Appendices I and II, have been agreed upon for all-English malt flour and malt extract. These designations and definitions have been given statutory effect in the Agricultural Produce (Grading and Marking) (Malt Flour and Malt Extract) Regulations, 1929.* Briefly, the regulations prescribe two grades of all-English Malt Flour, for use in baking white and brown bread, respectively, and four grades of all-English Malt Extract, namely, "Pharmaceutical," "Bakers' (white bread)," "Bakers' (brown bread)" and "Veterinary." These regulations mark an important advance in the standardization of these products. The definition of standards of quality for malt flour is an entirely new departure while, in the case of malt extract, the prescription of a minimum standard of diastatic activity is an innovation in the trade.

(2) *Marking.*—The Agricultural Produce (Grading and Marking) Act also enables the Minister to make regulations prescribing marks to represent grade designations, and any person who sells, delivers or exposes for sale an article marked with such a mark shall be regarded as using the grade designation represented thereby. *No person may mark any article, covering or label with a statutory grade designation mark unless authorized to do so by or under regulations made under the Act.*

(i) *The National Mark.*—A design in the form of a silhouette map of England and Wales bearing a circular representation of the Union Jack in the centre, around which are the words "Produce of England and Wales," has been prescribed in the Regulations referred to above as a mark, which, when used in conjunction with a grade designation, will constitute a grade designation mark.

This same design has been employed in connexion with other graded home-grown agricultural produce and has come to be known as "The National Mark." It has already acquired considerable advertising value, and, since buyers now realize that the National Mark is a reliable indication of quality, it is essential that the high standard associated with the Mark should be maintained in the case of every commodity to which it is applied.

(ii) *National Mark Committee.*—In accordance with the Agricultural Produce (Grading and Marking) (General) Regulations, 1928, a National Mark Committee has been appointed

* Obtainable from H.M. Stationery Office.

by the Minister with powers to authorize individuals or firms to apply the National Mark, subject to certain conditions, and to revoke or suspend any such authorization in the event of failure to comply with the prescribed conditions. Applications for authority to apply the National Mark should be made to *The Secretary, National Mark Committee, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.*

(3) National Mark Scheme for All-English Malt Products : General Arrangements.—The following are the general arrangements governing the voluntary scheme whereby all-English malt flour and malt extract which comply with the grade requirements may be marketed in containers bearing the National Mark.

(i) *National Mark Malt Products Trade Committee.*—A Trade Committee, which includes growers, manufacturers and distributors, appointed by the Minister, advises the National Mark Committee in regard to the issue of authorizations to apply the National Mark to all-English malt products ; it also advises the Minister on the general administration of the scheme.

(ii) *Authorization of Packers.*—Provided that they undertake to comply with the procedure and conditions set out below, the right to apply the National Mark may be granted (a) to manufacturers who prepare malt flour or malt extract, and (b) to packers who buy and repack malt extract already bearing the National Mark.

N.B.—The term “authorized packers,” as hereinafter used, refers to both manufacturers and packers who are authorized to apply the National Mark.

(iii) *Inspection Service.*—In a voluntary scheme of this kind, the amount of inspection required to ensure that the conditions are complied with should be small in comparison with a compulsory scheme, since manufacturers and distributors may, in their own interests, be expected to co-operate by reporting any cases of default.

The inspection service is supplied by the Ministry, and the system of checks employed seeks to ensure (a) that only home-grown grain is used (by an inspection of records and by taking samples of grain and malt), and (b) that the standard of quality is maintained (by taking samples of malt flour and malt extract).

Inspectors will not inquire into the particulars of any

technical process, except, and in so far as may be necessary, to establish the use or otherwise of English or Welsh grain.

(iv) *Authorized Packer's Right of Appeal.*—The National Mark Malt Products Trade Committee advises the Ministry with regard to complaints regarding supplies packed under the National Mark, and in the event of this Committee recommending, on account of failure to observe the required conditions, that the authorization granted to any packer should be suspended or revoked, the packer concerned, who will be duly notified, has the right of appeal to the National Mark Committee before the latter takes a decision on the recommendation. On the question of fact as to whether a particular sample of barley or malt is home-grown, the decision of the National Mark Malt Products Trade Committee must, however, be accepted as final by authorized packers.

(v) *Procedure and Conditions to be observed by Packers Authorized to apply the National Mark.*—(a) *Minimum Output.*—In the first instance, and until the scheme has passed the experimental stage, authority to apply the National Mark will be granted only to packers whose output attains a certain minimum volume, as follows :—

(i) *Manufacturers* must prepare 250 tons per annum at least of malt extract of all kinds and/or 100 tons per annum of malt flour.

(ii) *Packers* other than manufacturers must buy and repack at least 20 tons per annum of malt extract.

(b) *Purchase of Grain, Malt, etc.*—With a view to ensuring that no grain other than grain produced in England and Wales is used in the manufacture of National Mark malt products, authorizations to apply the Mark will be granted only to :—

(i) *Manufacturers who buy and use home-grown grain either unmalted or in the form of whole malt* for the preparation of National Mark Malt Flour or Malt Extract and who obtain from the seller an express guarantee that such grain or malt has been grown and produced in England and Wales and that the seller will, if need be, submit proof of origin. Further, in regard to any grain or malt so used, an authorized packer must agree to accept as final on the question of fact the decision of the National Mark Malt Products Trade Committee as to whether it is of home origin ; and

(ii) *Packers who buy and use crushed malt or malt extract from an authorized packer only* and who, in the case of crushed malt, require such authorized packer to give an express guarantee that the raw material was entirely of English or Welsh origin and/or, in the case of malt extract, require that the containers in which it is delivered shall bear the National Mark.

(c) *Grading : Observance of Grade Designations.*—Authorized Packers shall apply the National Mark only to produce which

complies with the definitions of quality prescribed for the grade designations. In this connexion, the maximum moisture content prescribed for malt flours shall be regarded as having reference to National Mark Malt Flours before leaving the authorized packer's premises.

Special Provisions regarding the use of Cod-Liver Oil.—Malt Extract of the "Pharmaceutical" and "Veterinary" grades may be mixed and sold in conjunction with cod-liver oil subject to the following conditions:—

- (i) The words "All English (Pharmaceutical) Malt Extract with Cod-Liver Oil," and/or "All English (Veterinary) Malt Extract with Cod-Liver Oil," as the case may be, shall be clearly marked on the label or container.
- (ii) The amount of cod-liver oil present shall in every case be 15 per cent. by volume of the total mixture. A variation of one per cent. of the total volume above or below this figure, as indicated by determinations made on samples drawn at the authorized packer's premises, shall, however, be allowed as a margin of error.
- (iii) The cod-liver oil as sold in conjunction with pharmaceutical malt extract shall be prepared in the manner, and correspond to the standard, laid down in the British Pharmacopoeia.
- (iv) The oil as sold in conjunction with veterinary malt extract shall be genuine, palatable cod-liver oil from which the vitamins have not been removed.

(d) *Packing.*—The containers used for National Mark malt flour and malt extract shall be clean, hygienic, and suitable for the purpose, provided that:—

- (i) As regards pharmaceutical malt extract (with or without cod-liver oil), packed and sold in quantities of 7 lb. or under, the National Mark shall not be applied except to produce contained in an amber glass jar of a type, size and shape approved by the Ministry. The container shall be of 1-lb., 2-lb., 4-lb., or 7-lb. size and shall be oval in shape, except in the case of the 7-lb. jar, which may be round. The Minister may, however, on the recommendation of the Malt Products Trade Committee, vary the above requirements to meet special circumstances and, more particularly, may, during the first six months of the Scheme, in special cases, allow authorized packers, as a concession, to use other shapes of amber glass jars until their existing stocks are exhausted.
- (ii) As regards bakers' malt extract, a case holding three dozen 1-lb. containers shall be recognized as a standard package for use with the National Mark and shall be sealed by a single National Mark label in such a way that the label is destroyed on opening the box.
- (iii) Other than as specified above there shall be no restrictions on the use of containers holding more than 7 lb., provided that the authorized packer informs the Ministry of the type and size of container to which it is proposed to apply the Mark.

(e) *Use of National Mark Labels.*—Authorized packers shall use only the serially numbered official labels bearing the

National Mark and the grade designation, which will be issued, on payment, to authorized packers by or on behalf of the Ministry of Agriculture and Fisheries. Labels may not be obtained from any other source. They are not transferable and care must be taken by packers to prevent them getting into the hands of unauthorized persons. Labels of a kind approved by the Ministry shall be used for each type of container employed. The quality of the contents of each package to which a label is applied must conform to the statutory definitions set out in Appendices I and II, according to the grade designation appearing on the label.

The label for each grade will be of a different colour ; labels which are mainly blue, red and yellow will be employed to distinguish pharmaceutical, bakers', and veterinary malt extracts, respectively ; blue and red will be used as the distinguishing colours for white bread and brown bread malt flours, respectively.

National Mark labels may be applied in addition to the authorized packer's own label.

(f) *Records*.—Authorized packers are required to keep a record showing the daily receipts of English barley, malt, crushed malt, or National Mark Malt Extract, noting in each case the quantity and the person or packer from whom received, and the serial numbers of the labels on the packages. A daily record must also be kept of the gristing and/or quantity of malt flour or malt extract made or packed for distribution under the National Mark. The serial numbers, by grade designations, of the National Mark labels used and applied daily must also be recorded.

(g) *Samples*.—Authorized packers must keep, for a period of not less than one month, samples (1-lb.) of the grain or malt as used in the daily gristing for National Mark Malt Flour or Extract, and also samples (1-lb.) of the National Mark Malt Flour made. Samples (1-lb.) of each lot of National Mark Malt Extract made shall be retained for a period of not less than three months. Authorized packers must, when required, supply samples or allow samples to be taken by a duly authorized officer of the Ministry, of any grain or malt used or likely to be used in the preparation of National Mark Malt Flour or Malt Extract and of any produce packed or intended to be packed under the Mark.

(h) *Association of Packers of National Mark Malt Products*.—An authorized packer shall, if and when required to do so by the Ministry, join any association or federation of packers of

APPENDIX I.—MALT FLOUR PRODUCED FROM BARLEY AND/OR WHEAT GROWN IN ENGLAND AND WALES : GRADE DESIGNATIONS AND DEFINITIONS

Grade Designation	Definition of Quality			
	Particular Characteristic	Common Characteristics		
		General	Moisture content	Special Ash content
All-English Malt Flour (White Bread)	Diastatic activity (or Lintner value)*	The flour shall be of the pure product of clean malted grain and be sound, free from taint or objectionable flavour, of good keeping quality, and otherwise shall comply with the requirements of the Food and Drugs (Adulteration) Act, 1928.	The moisture content, as determined by drying out a weighed quantity of the flour at 100° Centigrade, shall not exceed 10 per cent. of the total weight.	The ash content as ascertained in a muffle furnace shall not exceed 1.3 per cent. by weight of the total flour.
	Not less than 40			
All-English Malt Flour (Brown Bread)	No fixed minimum			The fibre content as determined in the manner prescribed in Appendix IV† shall not exceed 2.5 per cent. of the total weight of flour.

* The diastatic activity (or Lintner Value) shall be determined in the manner prescribed in Appendix III. (See note on p. 851.)

† See note on p. 851.

APPENDIX II.—MALT EXTRACT PRODUCED FROM BARLEY GROWN IN ENGLAND AND WALES : GRADE DESIGNATIONS AND DEFINITIONS

Grade Designation	Definition of Quality			
	Particular Characteristic	Common Characteristics		
		Protein content	Special	General
All - English (Pharmaceutical) Malt Extract	Diastatic activity (or Lintner value)*			
	Not less than 25	The amount of soluble protein, as ascertained by multiplying the nitrogen present (other than ammoniacal or nitric nitrogen, if any), by 6.25, shall be not less than 5 per cent. of the total weight.	The specific gravity shall be not less than 1.4.	The extract in each case shall be the entire and pure product of commercially sound, clean, malted grain, and shall otherwise comply with the requirements of the Food and Drugs (Adulteration) Act, 1928.
All - English (Bakers') Malt Extract (White Bread)	Not less than 40			
All - English (Bakers') Malt Extract (Brown Bread)	No fixed minimum			
All-English (Veterinary) Malt Extract	Not less than 15			

* The diastatic activity (or Lintner Value) shall be determined in the manner prescribed in Appendix III. (See note on p. 851.)

National Mark malt products established, with the Ministry's approval, for the purpose of regulating and developing the distribution of these products. The National Mark Malt Products Trade Committee will advise the Ministry regarding the rules and operations of this association or federation.

(i) *General*.—An authorized packer must allow his packing premises, equipment, stocks and records to be inspected at any reasonable time by an officer of the Ministry of Agriculture and Fisheries duly authorized in that behalf, and, if required, must allow any such officer to be present when National Mark malt flour or extract is being prepared or packed. Authorized packers are expected to afford inspectors every facility and assistance necessary to ensure that the integrity of the National Mark is maintained.

[NOTE.—*The above, with Appendices I and II and additional appendices describing the Method of Determination of Diastatic Activity (or Lintner Value), and of Determination of Fibre Content, is published as Marketing Leaflet No. 14, "Malt Flour and Malt Extract: Grading and Marking," copies of which can be obtained free of charge on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.]*

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LICENSING OF STALLIONS UNDER THE HORSE BREEDING ACT, 1918

THE number of stallions licensed under the Horse Breeding Act, 1918, in England and Wales during the licensing year ended October 31, 1929, was 1,436, an increase of 22 as compared with 1928.

<i>Service Season</i>	1923	1924	1925	1926	1927	1928	1929
Shires	1,634	1,195	953	829	772	720	760
Other heavy horses	486	424	350	324	328	313	329
Light horses (including ponies)	641	591	546	455	437	381	347
	<u>2,761</u>	<u>2,210</u>	<u>1,849</u>	<u>1,608</u>	<u>1,537</u>	<u>1,414</u>	<u>1,436</u>

This is the first occasion since 1921 that an increase on the previous year's total has been recorded. The increase was due to the greater number of heavy horses licensed, light horses again showing a decrease. Shires increased from 720 to 760, Clydesdales from 120 to 133, and Percherons from 38 to 41, but Suffolks showed a decrease of 3 to 129.

The number of Thoroughbreds licensed again showed a slight increase, *viz.*, from 164 to 166, but light stallions generally

TABLE I.—TOTAL APPLICATIONS AND LICENCES GRANTED.

BREED OR TYPE	PEDIGREE (i.e., Stallions entered or accepted for entry in the recognized Stud Book of their Breed)			NON-PEDIGREE (i.e., Stallions not entered or accepted for entry in a recognized Stud Book)			TOTALS OF EACH BREED AND TYPE (Pedigree and non-Pedigree)		
	Applications	Licensed	Refused	Applications	Licensed	Refused	Applications	Licensed	Refused
HEAVY—									
Shire ..	734	716	18	46	44	2	780	760	20
Clydesdale ..	127	127	—	6	6	—	133	133	—
Suffolk ..	133	127	6	2	2	—	135	129	6
Percheron ..	42	41	1	—	—	—	42	41	1
Others ..	—	—	—	29	26	3	29	26	3
LIGHT—									
Hackney ..	40	39	1	6	6	—	46	45	1
Thoroughbred ..	169	164	5	2	2	—	171	166	5
Arab ..	12	12	—	2	2	—	14	14	—
Cleveland Bay ..	4	4	—	—	—	—	4	4	—
Welsh Roadster ..	1	1	—	1	1	—	2	2	—
Hunter ..	1	1	—	2	2	—	3	3	—
Yorkshire Coach ..	2	2	—	—	—	—	2	2	—
Others ..	—	—	—	6	6	—	6	6	—
PONY AND COB—									
Welsh ..	12	12	—	2	2	—	14	14	—
Fell ..	15	15	—	—	—	—	15	15	—
Dales ..	11	11	—	5	5	—	16	16	—
Polo and Riding ..	14	14	—	—	—	—	14	14	—
Shetland ..	7	7	—	—	—	—	7	7	—
Highland ..	1	1	—	—	—	—	1	1	—
Welsh Cob ..	33	33	—	4	4	—	37	37	—
Others ..	—	—	—	1	1	—	1	1	—
TOTALS ..	1,358	1,327	31	114	109	5	1,472	1,436	36

(including ponies) declined by 34 to 347. Hackneys and Welsh Cobs accounted for the greater part of this decrease, only 45 Hackneys being licensed against 63 in the previous season and 37 Welsh Cobs against 50.

In 36 cases licences were refused by the Ministry, and appeals

TABLE II.—APPLICATIONS FOR LICENCES NOT GRANTED AND GROUNDS OF REFUSAL.

BREED	Number of Applications	Number Refused	Percentage Refused	DISEASE						
				Cataract	Roaring	Whistling	Ringbone	Sidebone	Bone Spavin	Stringhalt
PEDIGREE—										
Shire	734	*18	2·5	2	8	3	1	2	—	1
Suffolk	133	6	4·5	—	—	3	1	1	1	—
Percheron ..	42	1	2·4	—	—	—	—	1	—	—
Hackney	40	1	2·5	—	—	—	—	—	—	1
Thoroughbred	169	†5	3·0	1	—	1	1	—	—	1
NON-PEDIGREE—										
Heavy	83	5	6·0	2	—	1	—	2	—	—
Total Refusals..	—	36	—	5	8	8	3	6	1	3

* A licence was also refused in respect of a Shire stallion that had proved to be inadequately prolific.

† A licence was also refused in respect of a Thoroughbred stallion that had been "tubed" and could not, therefore, be examined for its "wind."

against refusals were lodged under paragraph 12 of the Regulations in twelve cases, six of which were successful.

Fewer cases of infringement of the Act were reported this season. There were no unlicensed stallions reported on the road, but four unlicensed stallions were reported as being exhibited for service; applications for licences for two of these, however, had already been made. Ten stallions, though licensed, were found to be travelling unaccompanied by the licences.

Stallion owners in possession of licences for the year ended October 31, 1929, are reminded that these licences expired on that date, and should have been returned to the Ministry. Applications for licences for the service season November 1, 1929, to October 31, 1930, should be made as early as possible on forms which may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

THE WORKING OF THE SEEDS ACT, 1920, IN THE SEASON 1928-29

THE Seeds Act has now been in operation for a period of eight years. In the light of the experience gained during that time, it may be justly claimed that the Act has fulfilled its object in requiring the seller to disclose certain essential facts regarding the seeds he sells—so placing the purchaser in a position to judge the comparative value of the seeds with a fair degree of accuracy. The purchaser is also safeguarded against purchasing, in ignorance, seeds of low vitality or seeds containing noxious weed seeds and other impurities. In order to give some elasticity to the details of control required under the Act, the Ministry is empowered to make Seeds Regulations ; and it may be claimed that these have also stood the test of time, since those now in operation have not been varied since 1922. It is true that alterations to both the Act and the Regulations are suggested from time to time. Some of these suggested alterations have for their purpose an extension or tightening up of the requirements, whereas others are put forward with the object of easing the irksomeness which any measure of control of this nature must of necessity bring to those affected. It seems clear, however, that no one is anxious to see the present regulations in the melting pot, because, although a general revision might secure for them the point they desire, it would probably also result in other alterations which might adversely affect the position from their point of view. In the meantime the seller has now recognized that the testing and other requirements of the Act are part of the normal routine of his business, whilst the purchaser is appreciating more and more the value of the particulars that he has a statutory right to expect with his seed.

With the best of intentions, however, sellers occasionally make slips in fulfilling the responsibilities that are laid on them by the regulations. An instance of this kind might be quoted as a warning to those who may be, quite innocently, failing to comply with the requirements of the Act as regards the wording of the statement of particulars in their seed catalogues. Section 1 (4) of the Act provides that “ a statement in writing referring specifically to a printed price list or printed catalogue containing the prescribed particulars shall be deemed to contain those particulars,” *i.e.*, the particulars required to be given under Section 1 of the Act. It is believed, however, that, in many cases where this form of declaration is used, the requirements of the Section are not being carried out as

strictly as they should be. For instance, during the course of a recent action in the High Court, it was contended that the form of words used in a seedsman's catalogue, which read : " All ——'s seeds have been tested for germination and purity and conform to the provisions of the Seeds Act, 1920," was not sufficient. Mr. Justice Horridge said that, if he were called upon to give his judicial ruling on this point, he would rule that these words were not in law a proper compliance with the Seeds Act and the Regulations. It is clear, therefore, that the form of words used should follow closely the wording of the Regulations.

A formula which is in common use, and to which there appears to be no objection, reads : " All the seeds enumerated in this catalogue which are subject to the requirements of the Seeds Act, 1920, have been tested in accordance with the provisions of that Act, and the analytical purity and germination are not less than the authorized minimum percentages prescribed in the Regulations unless otherwise stated." It is, of course, necessary to add to these particulars the authorized minimum percentage of germination in respect of each kind of seed for which a minimum is prescribed, and also to give the full particulars required in connexion with seeds such as Clovers and Grasses for which no minimum percentage is laid down.

Cases have also been brought to the Ministry's notice in which the seedsman, having given the full particulars in his catalogue or price list, has assumed that no further declaration was necessary, whereas the Regulations require " a statement in writing referring specifically to the printed price list or printed catalogue containing the prescribed particulars."

An Important Judgment.—A case was heard at the Daventry County Court on June 21, 1928, before His Honour Judge M. A. Dracquer, in which a farmer claimed payment for 13 quarters of seed wheat sold to another farmer in March, 1927. The Defendant lodged a counter-claim for loss of crop. He alleged that the seed was of bad quality and mixed with barley. The Defendant also submitted that Plaintiff had no claim as he (the Plaintiff) had failed to deliver the statement as to percentage germination required by the Seeds Act. His Honour reserved judgment on the point of law as to whether the failure to give the certificate of germination was a bar to recovery. In delivering judgment on July 4, 1928, His Honour reviewed the transaction, and said that as no complaint as to the resulting crop was made by the Defendant

until December, 1927, he was not satisfied with the suggestion that the seed was not up to sample. He therefore considered that the defence failed, and that the counter-claim also failed. With regard to the other part of the defence, i.e., that the Plaintiff failed to give a germination certificate, and that such failure rendered the contract void, His Honour pointed out that the principle of law involved was that the contract was expressly or impliedly forbidden. He had no doubt that the contract, although not exactly prohibited, was impliedly prohibited if the certificate were not given. The result, said His Honour, was that the failure to issue the certificate in this case was a criminal offence, and his opinion was that it was impossible for the Plaintiff to come to the Court and enforce a contract in which he had committed a criminal offence. He therefore gave judgment for the Defendant without costs on the claim, and judgment for the Plaintiff with costs on the counter-claim.

A similar judgment was given by His Honour Judge Farrant at Peterborough on March 31, 1925. In that case a farmer was sued for the price of some maple peas, and set up the defence that as the statement required under the Seeds Act had not been delivered, the contract for the sale and purchase of the seed was illegal, and therefore unenforceable. His Honour decided that this defence was a sound one, and delivered judgment for the Defendant with costs.

Visits to Seedsmen.—Some 6,250 visits to seedsmen's premises were paid during the season to ascertain whether the requirements of the Act were being properly carried out, and to draw control samples. These visits included 1,150 to premises which had not been visited before, and were mostly shops at which the sale of seeds had been taken up as a side line to the normal business. The constant necessity of keeping in touch with this class of seller of seeds is still one of the difficulties met with in administering the Act. The established seed merchant is fully aware of his responsibilities under the Act, but the tradesman, especially the newcomer in business, who sells small quantities of seed as a side line during a short period of the year, is not so well informed and requires constant attention.

Control Sampling.—1,723 control samples were taken during the year for check testing at the Official Seed Testing Station. These samples included 332 of clovers, 197 of grasses, 20 of field seeds, 427 of root seeds—including 73 of sugar beet—214 of vegetable seeds, 71 of cereals and 462 of packeted

seeds. Apart from the packeted seeds the check test showed that the particulars given by the seller were materially inaccurate in 46 cases. These included 7 samples of grass seed, 20 of clover, 13 of root and 6 of garden seeds. In 9 cases the germination was found to be overstated to the extent of from 10 to 15 per cent., in 3 cases from 15 to 20 per cent., and in 9 cases the discrepancies were 20 per cent. and over. In 6 cases the purity stated was from 3 to 5 per cent. too high, in 5 cases from 5 to 10 per cent., and in 4 others 10 per cent. and over. There were also a number of cases in which the seller had failed to give the country of origin in the case of grass and clover seeds, or the bushel weight in the case of rye-grass seed. Taken as a percentage of the total number of control samples drawn, the discrepancy cases represent 3·6 per cent., as compared with 6·5 per cent. in 1927-28, 4·7 per cent. in 1926-27 and 6·6 per cent. in 1925-26. In view of the excellent harvest conditions in 1928 a low "discrepancy figure" was anticipated, but it was not expected that it would fall to such a record low level. This result is very satisfactory as it indicates how closely the actual quality of the bulk of seeds sold corresponds, so far as germination and analytical purity are concerned, with the particulars declared by the sellers.

Packet Seed.—The experience of the past season has shown that the trade in packet seed is getting more and more into the hands of those wholesale houses which specialize in this class of trade on a sale or return basis. This movement is a distinct advantage to the gardener as he is now practically certain of getting fresh seed of high quality, instead of, as used to be common before the Act came into operation, seed which in some cases had been packeted for years and was brought forward for sale season after season until the stock was exhausted. Of the 462 samples of packet seed taken as control samples 93·5 per cent. were found to be at or above the minimum percentages of germination and purity laid down by the Regulations. This shows a distinct improvement on the 1927-28 season, when the corresponding figure was only 86 per cent. 1·9 per cent. of the samples showed a germination below the minimum but above two-thirds, and 2·4 per cent. were below two-thirds.

Licensed Private Seed Testing Stations.—Three licences, for testing cereal seeds only, have been surrendered during the past season. This brings the total number of licensed stations down to 83. All the stations have been inspected at least

once during the year, and in the case of some which require special attention as many as five visits have been paid. In addition to inspecting the apparatus, records, etc., at these stations, some 1,500 samples have been drawn to check the results obtained by the analysts in charge. The results of the check tests have shown a satisfactory improvement in the uniformity of results obtained. In addition to taking these check samples the usual series of six sets of "Referee" samples was distributed for comparative testing at the licensed stations. These samples included white clover, cocksfoot, rye-grass, onion, mangold and swede. Reference is made below to the observations which the Chief Officer of the Official Seed Testing Station made at the Seed Analysts' Annual Conference with regard to the results obtained with the Referee samples. On the whole the results were not unsatisfactory, the principal defects being apparently due either to lack of adequate apparatus, inexperience in handling particular kinds of seeds, or failure to detect abnormal growths.

Training and Examination of Seed Analysts.—The eighth course of training for seed analysts was held at the Official Seed Testing Station, Cambridge, from June 25 to July 23, 1929. Seven analysts attended the course and, with one other analyst who had not taken the course, sat for the examination held on July 24 and 25. Of these eight, four satisfied the examiners and were awarded a pass certificate; one passed in her practical work only, the other three failed.

Seed Analysts' Conference.—On July 26, the 7th Annual Conference of Seed Analysts was held at the Official Seed Testing Station, Dr. Beaven, the Chairman of the Council of the Institute, being in the Chair.

The Chief Officer gave a review of the results of the series of referee samples that had been sent out during the season to all licensed stations. He drew special attention to the necessity of paying particular care to the subject of broken growths and growths with some abnormal character, failure to distinguish which led to many discrepancies in results of tests. He also pointed out that the germination results obtained with Mangolds were not very satisfactory, this probably being due to lack of facilities for obtaining a sharp fluctuation of temperature, inefficient watering and not pressing the clusters into the sand sufficiently. As regards Mangolds, too, he said that there appeared to be a tendency, particularly with left-over seed, to assume that the purity was at or above 97 per

cent.; careful scrutiny of such was necessary, particularly for the purpose of noting the empty clusters.

At a later stage in the proceedings the Chief Officer again referred to the subject of weakly and defective growths, and growths of an abnormal character. He said he understood the United States Authorities were somewhat disturbed over the quality of the shipments of seeds, more especially *Trifolium*, received from Europe. Soil growths were being found to be much less than the laboratory tests on which the seeds were sold. The United States proposed to interpret laboratory tests in the light of soil tests. The Chief Officer said he was uncertain what this actually meant, but it seemed clear that the U.S. Authorities were likely to be very strict regarding the admission of seeds which did not do well in soil tests. He had also had a letter from Australia which stated that shipments of vegetable seeds from the United Kingdom were often inferior in germination capacity and lost vitality more rapidly than was the case with similar seeds shipped from the United States and certain European countries. He was of the opinion that the root of this trouble was the failure to remove broken growths, and that this was a matter that should be given careful consideration, particularly by analysts attached to firms who had an export trade.

Mr. Anderson, of the Scottish Official Seed Testing and Plant Registration Station, read an interesting paper on the identification of varieties of the cultivated Oat, by reference to seedlings. Several speakers emphasized the importance of the subject dealt with by Mr. Anderson, and expressed the hope that it might be possible to develop a technique which would enable the variety of other plants to be determined in the seedling stage.

During the afternoon the fifth annual meeting of the British Association of Commercial Seed Analysts was held, Mr. N. L. Dickson again being elected President and Mr. A. E. Birks, of Stoughton Grange, near Leicester, as Secretary-Treasurer.

"Seed Analysts' Bulletin."—Further issues of this Bulletin were made during the season under review. They contained references to the work carried out at the English and other official seed testing stations, notes on laboratory practice, the administration of the Seeds Act, foreign and colonial seed import regulations, and various other items of interest to private seed analysts.

Seed Wheat Survey.—A further series of samples of seed wheat was drawn "from the drill" in the eastern counties

during the autumn of 1928, for the purpose of collecting information as to the quality, variety and other characteristics of the seed wheat sown in this area. The results of this inquiry have already been published in this JOURNAL (May, 1929, p. 137).

Testing of Seeds for Export to the Colonies.—During the season some 1,099 samples of seed were submitted for free testing under the scheme by which, with the assistance of a grant from the Empire Marketing Board, tests may be made free of charge at the Official Seed Testing Station of samples of seed intended for export to the Colonies in cases where the Colonial seed import regulations require consignments of seed shipped from this country to be accompanied by an official test certificate. The purpose of this scheme is to facilitate the trade with the Colonies in home-grown seed. The samples tested during the year included 104 of grasses and clovers, 165 of mangold and beet and 830 of vegetables and pulse.

Export of Red Clover to the U.S.A.—The United States Federal Seeds Act requires that seeds of alfalfa or red clover, or any mixture of seed containing 10 per cent. or more of these seeds imported into the United States, shall be coloured to the extent of 1 per cent. of the seed in each container with a specified colour to denote the country of origin. In addition, the regulations require that a certificate, issued by the properly authorized official of the foreign country in which the seed was grown, to the effect that the seed was grown in that country, must be attached to the consular invoice. The latter requirement raised considerable difficulty in connexion with shipments of red clover seed that merchants wished to make from this country to the U.S.A. after the prolific red clover seed harvest of 1928. Arrangements were, however, eventually made with the American Consul-General in London which enabled the Chief Officer of the Official Seed Testing Station at Cambridge to issue the necessary certificate.

Seed Potatoes.—Some improvement is shown in the manner in which the requirements of the Act as regards the sale of seed potatoes is being carried out, although this remains the most difficult section of the Act to administer efficiently. Special inquiries were instituted in 37 cases during the season, 17 being in connexion with alleged misstatements as to variety, 15 as regards size and dressing, 2 as regards "Class," and 3 in which insufficient particulars were given by the seller. In 16 of these cases it was found that the seed came from Scotland,

and full particulars were therefore reported to the Department of Agriculture for Scotland for such action as they considered necessary. Legal proceedings were taken in four cases, 3 in Scotland and 1 in England, particulars of which are given in the summary of prosecution cases which follows.

Prosecutions.—The following are brief particulars of the prosecution cases which have been taken under the Seeds Act during the past season :—

(1) In August, 1928, proceedings were taken in Scotland against a Scottish seed potato merchant for making a false statement as to the size and dressing of a consignment of seed potatoes supplied to an English customer. Samples drawn by the Ministry's Inspector showed that approximately 60 per cent. were over-sized. The defendant pleaded guilty, and was fined £2.

(2) In September, 1928, a Handsworth merchant, who had been convicted twice previously, was charged with selling onion seed with a declaration that the germination was not less than the authorized minimum, whereas a check test on a control sample showed it to be considerably below the standard. A fine of £5 was inflicted.

(3) In September, 1928, a Gloucestershire seller was charged with a similar offence regarding the low germination of onion seed. The Bench thought that the defendant had acted without intent to defraud and imposed a nominal penalty of 10s.

(4) At Forfar on December 20, 1928, a firm of seed potato merchants were fined £3 for supplying an English grower with seed the crop from which contained 10 per cent. of rogues.

(5) At Glasgow Sheriff's Court on April 29, 1929, a firm of seed potato merchants were fined £10 for making a false statement as to the variety of a quantity of seed potatoes sold to an English farmer. Examination of the crop by officers of the Ministry showed that it contained approximately 25 per cent. of rogues. It transpired during the case that the potatoes had been sold to the defendants as "ware" potatoes, and that it had been clearly pointed out to them that no inspection of variety had been made. Two previous convictions for a similar offence were proved against the defendants.

(6) On June 25, 1929, a seedsman of Bedford was prosecuted for failing to give the particulars prescribed under the Act on the sale of a quantity of runner bean

seed. The defendant pleaded not guilty, but was convicted and fined 5s. and 2 guineas costs.

(7) A Lincolnshire firm of potato merchants was prosecuted by the Ministry at Boston on July 3, 1929, for failure to give the necessary particulars as required by the Seeds Act in the case of a sale of seed potatoes, and was fined 10s. with £8 15s. 0d. costs. A second charge for making a false statement as to the size and dressing was dismissed, as the Bench were not satisfied that the case had been proved.

General.—Copies of the Seeds Act, 1920 (price 3d. net); the Seeds (Amendment) Act, 1925 (price 1d. net); and the Seeds Regulations, 1922 (price 3d. net), may be obtained through any bookseller, or direct from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2.

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COUNCIL OF AGRICULTURE FOR ENGLAND

THE thirty-first meeting of the Council was held on Thursday, October 31, 1929, at the Middlesex Guildhall, Westminster, Lord Strachie being in the Chair. The chairman cordially welcomed Mr. Buxton, Minister of Agriculture, and Dr. Addison, Parliamentary Secretary to the Ministry, on their first attendance at a meeting of the Council under the present Government.

Publicity for Council's Reports.—*Mr. Denton Woodhead* said that, arising out of the minutes of the last meeting, it was his duty, as chairman of the Standing Committee, to make a statement on this subject. Several thousand copies of each of the Council's Marketing Reports were circulated on issue. Most went to county councils and to officers of county agricultural staffs, and for distribution to farmers' associations and others interested in the various counties. In addition, reports were published in the JOURNAL and notices of them were made from time to time in the Ministry's Wireless Bulletins and Press Services.

Cereal Marketing.—*Mr. Denton Woodhead* moved the adoption of the Report of the Standing Committee on the Marketing of Home-grown Wheat, Barley and Oats in England and Wales. He said that the matter was important not only to agriculturists but to townspeople, because agriculture had been called upon for many years to provide cheap food for the nation, and it had done so at great sacrifice both by the

farmer and the farm labourer. To-day, the country was suffering from a surfeit of imports of almost every kind of agricultural produce, and the English farmer was at his wits' end to know what to do. Putting land down to grass was no proper national remedy. It meant unemployment in the countryside, and the drifting of workers to towns, and more consequent unemployment there. The report considered that some improvement could be effected through better marketing, and it was, in any case, confined to that subject. It did not recommend any revolutionary change. Mr. Woodhead named the chief items considered and the suggestions made on them as set out in the Report, which is printed as an Appendix (*See p. 872*). He appealed particularly to the housewives of the country to use home-grown flour as much as possible both for making bread and pastry, &c.; they would find it an advantage, since the flavour of English wheat was really excellent.

Mr. Noel Buxton, M.P., Minister of Agriculture, thanked the Council for their cordial welcome. He said that he had followed the discussions of the Council with great interest, and appreciated the lead the Council had given to public opinion on agricultural questions. Especially had he noticed what the Council had elaborated on marketing, a subject in which the Labour Party took a great interest. The National Mark had gone ahead with a speed which nobody could have anticipated. It was now applied to apples, pears, eggs, tomatoes and cucumbers, export-broccoli, All-English flour, home-killed beef, and it was now in prospect to apply it to potatoes, malt flour and malt products, poultry, canned fruit, cider, cream and honey. One hundred and fifty packers and millers were already authorized to use the National Mark for All-English flour, and over one million labels had been sold.

The Minister took the opportunity of thanking the Press for the great interest they had shown in the movement, and he endorsed Mr. Woodhead's appeal to the housewives of the country. His own experience of All-English bread was that since he had had it at home he had noticed a great improvement, and he could endorse what the Mover said as to the high value of English wheat. Standardization of flour by "fair average quality" was a sound idea, and the Ministry would proceed with it. The marking of malt products was already in hand, and would come into force on December 1. As to oatmeal, the Ministry would very carefully consider whether the National Mark could be applied to it. On the subject of

area selling agencies in a plan of orderly marketing, he could only say that if and when farmers were ready to support such a scheme, the Government would give sympathetic treatment to the suggestion that free storage for grain should be supplied.

The public had now a chance, under the National Mark system, of getting flour which was known to be free from chemicals. He would consult the Minister of Health on the question of water content in the loaf to see whether a maximum allowance could not be established. As regards the suggestion that brewers should use only home-grown barley, he would take an early opportunity of renewing the appeal when he met them at the Brewers' Exhibition on November 2.

Mr. H. W. Thomas (Hants) said he did not think the Report would encourage the grower of wheat in this country to any appreciable extent. The poultry dealers were prepared to give about 3s. a quarter more than the miller. A few years ago when the harvest was not so good as it was this year, a miller had told him that he was buying no English wheat, only imported. He did not see how the grading of wheat could help, unless it was grown in similar ground and under similar management and conditions; anyhow, the wheat price was at present dependent entirely on the price of imported corn, and unless something practical could be done to increase the price of home-grown wheat, the crop could not prosper in this country. *Mr. A. E. Bryant* (Bucks) said that although the Report was a step in the right direction, it did not go very far to solve farming troubles. The dumping of "cheap-labour" food from other countries should be stopped, or soon no home-grown corn at all could be put upon the market. He was disappointed with the Standing Committee's Report, because he did not see the use of advice as to how to market produce that was produced at a loss.

Mr. Christopher Turnor congratulated the Committee on what he considered to be a very able report, particularly because it was so moderate. It proposed the first steps that should be taken; the higher organization would come later. Take what happened in the Eastern Counties as regards barley; buyers there decided, in a recent year, that there was no barley of quality in England, and bought it from abroad. If there had been an organization of farmers that could say that so many tons of barley were available, it would have greatly helped to get the position right. With regard to wheat, when foreign grain flooded the market, down went the price. An organization to control and distribute the home

crop seemed necessary, and such an association might also be useful in helping the farmer with credit. There was no question that home wheat bread far surpassed bread from imported flour in flavour and in wholesomeness. He made the suggestion that Women's Institutes, Girl Guides, and even Boy Scouts, might be the vehicles for propaganda on this subject reaching into the homes. As to storage, the Government should not make large provision; it should be just enough to enable a Control Board to regulate the supply. It was of no advantage to farmers to combine in associations if only 30 to 40 per cent. were supporting the movement; at least 80 per cent. should come in.

Mr. R. G. Patterson, O.B.E. (Staffs), reminded the Council that the report was one on marketing and not, as Mr. Bryant seemed to think, one on agricultural depression. As a member of the Standing Committee, he was pleased to see that some members appreciated the work which had been put into the report. In his view, the arable farmer was to-day in a very critical position. Were tariffs and subsidies really ruled out, in view of the fact that the Government had just announced that the coal consumer would pay a larger price, for the benefit of the coalmining industry? This Government, or some Government, should devise methods by which agriculture might be raised from the position in which it stood to-day.

Mr. T. Lovell said that in his own village in Somerset, where there was a building and brickmaking industry with a standard wage of 1s. 0½d. per hour, unemployed lads were coming in from the country who offered their labour at 10d. an hour. There were 117 townsmen at the moment on the dole. *Mr. G. E. Hewitt* advocated the establishment of an Imports Board; he had found that in the case of black currants, even, these were dumped at a time when the home crop was being brought on the market, and so growing was made unprofitable. Licences should be issued to import, and these should not operate until the foreign produce was wanted. Profits were not coming into the industry such as would enable agricultural labourers to live on the scale of other workers.

The Report was adopted by the Council.

Cattle and Beef Marketing.—*Mr. Denton Woodhead* moved the adoption of the Standing Committee's Report, recommending to members of the Council the Ministry's Report on the marketing of cattle and beef in England and Wales, which was, through the generosity of the Empire Marketing Board, purchasable for 6d. The Committee's Report stressed

the need of better planning and construction in the case of new public abattoirs about to be erected, and the adoption by more towns and cities of central slaughtering, in up-to-date premises, in place of the indiscriminate and necessarily wasteful work in private slaughter-houses. It was an essential part in any better marketing system that this link in the chain should be a piece with proper grading and marking of carcasses under the National Mark, so that when the time came for the adoption throughout the country of the sale of English and Welsh beef under the National Mark, the produce would be sold to the public in the best possible condition. In this connexion the Report stated that the Standing Committee was watching the experiment in the grading and marking of English and Welsh beef in Smithfield Market, London, with great interest.

The Report was adopted.

German Wheat.—*Professor A. W. Ashby, M.A.*, moved the adoption of the following resolution on behalf of the Standing Committee :—

“That this Council considers the importation of cereals, which are, in effect, bounty-fed and can be sold in this country at less than the economic price for home-grown grain, to be extremely detrimental to British agriculture, and urges the Government to take immediate steps to stop this unfair competition.”

He said that there was a good deal of confusion about this subsidized or bounty-fed grain. The system under which this grain comes into the country had, in fact, been in existence since 1894. Between 1894 and 1906 it was working in Germany and did not do very much damage to farmers, partly because in those days the bond of import on shipping was only exchangeable for the same grain as it was issued for : that is to say, if the exporter exported wheat and got an import bond he could use that bond or sell it for use in paying the duties on the imported wheat only. In 1906, that system was changed over, and, at the present time, the import bond which is obtained for the shipping of any grain, wheat, rye or oats can be exchanged equally for any other grain. That system had been in existence for 22 years at least : it had not hurt this country much until the last two or three years. The present position was that the German exporter of wheat could get 3s. 3d. per cwt. on his exports. He gets a bond for that value which he can sell to an importer for something less than 3s. 3d., and the importer can use that bond to pay the import duty on wheat or other grain which he imports into Germany. The German taxpayer did not pay anything directly

under the system. The German taxpayer did not directly subsidize the export of grain to this country. What happened was that the German Treasury lost the import duties on grain to the same amount as they issued bonds for the export of grain. Professor Ashby went into further details of the position, and added that this was not the only case where subsidized produce was imported from overseas, and suggested that the Government or the War Office might buy up the whole of the German wheat importation and so save the British taxpayers and the farmers at the same time. It might be that the Government could move on the broad principle of attaching all subsidized imports, putting them out on the home market as required, but not to the damage of the home producers. *Mr. Wearmouth* (Durham) seconded the motion. *The Minister*, in reply, said that he would not burden the Council by repeating what he had said in the House of Commons yesterday. He felt most keenly the detrimental effect of these importations of German corn, which sadly affected his own neighbours in the Eastern Counties. In Scotland the evil was, if possible, greater still. The Government was looking for methods of dealing with the situation adequately. He did not find any of these in the suggestions which had been put forward by the National Farmers' Union, in which the Treaty position, which he then discussed, was dealt with. Considering the volume of the importation, the Minister said that the figures for last year were 123,000 tons of wheat as against 9,000 tons the year before, 34,000 tons in 1926-27, and 178,000 tons in 1925-26. He hoped that some feasible plan would soon be discovered to deal with the matter within the limits of the principles of all parties. *Brigadier-General Clifton Brown, M.P.* (West Sussex) repeated *Mr. Runciman's* suggestion that the Foreign Office should have the matter taken up internationally. *Mr. George Edwards* assured the Minister that many of the staunch supporters of the present Government felt very strongly on the question of this bounty, and considered that some immediate steps should be taken. He also advocated a Control or Import Board for wheat. Such a Board would obviate the need of dabbling in Tariff Reform.

Mr. H. C. Gardner (Worcestershire) asked why the question had not been dealt with by a previous Government of the country, and suggested a comparison with the sugar industry of the West Indies. *Mr. H. E. S. Upcher* (Norfolk) said that agricultural wages were about one-third too high, and were kept at that figure, not by the economics of the industry, but

by law. Since tariffs were not possible, he would suggest an acreage subsidy on cereals, or a subsidy on farm labourers' wages. Sugar-beet had been advanced considerably under the subsidy, which had kept Norfolk agriculture alive; he did not know what the result would be when that subsidy came to an end. *Mr. W. Holmes* said he thought that the farmers were already having a subsidy in the shape of relief of rates. In the past, farmers had been very shortsighted in preventing workers becoming organized, for, if there had been organization the present Government might be inclined to help agriculture more. *Col. Sir G. L. Courthope, K.B.E., M.P.* (East Sussex), said that the best definition of the economic wage of an arable worker was the old one—the price of a sack of wheat. He hoped that the Government would give up talking about the Treaty in connexion with the German cereal importation; it was clearly its business to find a remedy. *Mr. Christopher Turnor* said he was at last beginning to understand the term "favoured nation clause." It meant that the other nation had the right to exploit this country, which had to sit down under the exploitation without remonstrance. The Government was pledged to maintain and, if possible, raise the standard of wages and of living. The importation of bounty-fed products cut right across that policy, and he associated himself with the mover in demanding that all such imports should be stopped. *Lieut.-Col. Lord Wynford, D.S.O.* (Dorset), said that on the merits of the case he thought the Council were agreed, and he suggested that the Minister should take as firm a stand on this question as did the Minister's colleagues at the Hague recently on the subject of national finance.

The resolution was then put to the meeting and carried *nem. con.*

Home Marketing.—*Mr. Clement Smith* (East Suffolk), on behalf of the Standing Committee, moved:—

"That this Council suggests with deference that the Empire Marketing Board might devote more time and money to advertising home-grown produce for sale in our Home markets."

Mr. Clement Smith said that the Empire Marketing Board, set up in 1926 to further the marketing of Empire produce, had an annual grant of £1,000,000. He likened the Board to what might be called a million-gallon cow, to which there came a very large number of applicants with buckets to receive its nourishing support. The Ministry received £40,000 a year, which enabled it to conduct investigations, demonstrations, etc., and bring out the valuable Economic Series. There was a grant to Cambridge of £50,000, and various

sums to other institutions for research work. Then there was the assistance to the Royal Agricultural Society, etc., in respect of quarantine stations, and also financial help for the transport of pedigree stock to other countries. This was well; but there was so much publicity given in this country to overseas produce and very little as to our own. He thought that home produce should be brought prominently before the British public, or the British producer would suffer. He would go further and suggest that our products, such as pedigree stock, should be advertised by the Board in the Dominions. *Mr. J. Hamilton* (Lancs) seconded the resolution. *Sir Douglas Newton, M.P.* (Cambs.), said he was in thorough accord and sympathy with the motion. He drew attention to the recent exhibit of the Board at Newcastle. It was very good, though the English fruit section was not up to standard; the comparison it gave with the overseas products was not a fair one.

Dr. Addison, M.P., on behalf of the Ministry, said that he cordially welcomed the discussion and the valuable criticism which had been made. The purposes for which the Board was created had to be remembered, and so far as the Ministry was concerned, it was very grateful to the Board for the help which it had already given. He gave figures showing how the advertisements were distributed among the Home country and the Dominions, and showed that this country had a larger share of the Empire Marketing Board's activities than the mover appeared to think. At the same time, the Ministry was fully alive to the claims of home-grown produce, and would watch the position; the Empire Marketing Board was also very sympathetic.

The resolution was then put to the meeting and carried.

Grain Elevators.—*Mr. Denton Woodhead*, on behalf of the Standing Committee, moved:—

"That this Council would be glad to be informed of the intentions of the Government in regard to the erection of grain elevators in this country for the special purpose of accommodating this country's importation of Canadian Wheat. The subject has a bearing on the creation of a Wheat Imports Board, which is referred to in paragraph 3 of the Standing Committee's Report on the Marketing of Wheat, Barley and Oats; and the Council is apprehensive of the effect on the Home wheat market of the existence of large supplies of stored wheat, unless their release is under proper control."

Mr. Woodhead said he would be glad if *Dr. Addison* could give the Council any information on the subject of the resolution. *Mr. J. Hamilton* seconded.

Dr. Addison said that there had been a good deal of apprehension in the country, and he was glad of an opportunity to remove it by a statement. The facts were as follows : *Mr. Thomas* made representations to the Wheat Pool in Canada and raised with them the question of a more even flow of cargoes of grain from Canada, with a view to ensuring a regular return cargo for ships that might take British cargoes to Canada. He asked the Wheat Pool if the irregular release of grain was due to lack of storage ; if so, he thought we might consider the possibility of giving assistance over here. The representative of the Wheat Pool stated categorically that the existence of accommodation for storage of grain in England had nothing to do with the release of grain from Canada. However much elevator accommodation may be available in Great Britain, they would not send grain to Great Britain unsold. Therefore, an increase of the present elevator accommodation, much of which they knew was not fully occupied, would not promote the object which *Mr. Thomas* had mentioned. The matter was left in this position, and has not subsequently been discussed. It was raised simply as a suggestion of what might be done, but not to increase the present grain exports from Canada. The suggestion merely was one to regularize the flow of grain with a view to making the best use of the shipping available. So far as the elevators are concerned, therefore, the matter has proceeded no further.

In view of this statement, *Mr. Woodhead* withdrew the resolution by leave of the Council.

Graded Milk.—*Mr. Charles Roberts* (Cumb.) moved :—

“ That this Council requests the Minister of Agriculture to use his influence with the Minister of Health in order to secure a revision of the terminology, the scale of fees, and the regulations respecting graded milk.”

Mr. Roberts said that the question was really one of assisting in the stamping out of animal disease, and was, therefore, one for the Ministry of Agriculture. *Sir George Newman*, of the Ministry of Health, had said last year : “ There is no one in this Congress who finds the new designations more unhappy, uncomfortable, inconvenient and confusing than myself.” The Council knew what “ Grade A,” “ Certified ” and “ Tested ” meant, but the terms were not self-explanatory. “ Certified ” was not a popular word, though a word of the kind which appealed to a Government. In the country, it was associated with lunatic asylums. “ Grade A,” on the other hand, was thought to be the best grading, which it was

not. Everyone admitted that the grades were wrong, but action was not taken. He asked that the Ministry, who knew both sides, should try to get the position altered.

He would suggest that "Certified" be cut out altogether, and that "Grade A, Tuberculin tested," either "Farm bottled" or "Shop bottled," should be the top grade. Then, afterwards, there was the pasteurized milk which, as someone had said, was milk that had not the decency to turn sour when it had gone bad.

As regards fees, he thought a charge of £5 did prevent farmers taking out "Grade A" certificates. The numbers who produced "Certified milk" and "Tuberculin tested" milk were very small. Some regulations also were ambiguous, and puzzled the local authorities while others, again, were calculated to make it difficult to produce graded milk. *Mr. Upcher* seconded the motion.

In reply, *Sir Charles Howell Thomas, K.C.B.*, on behalf of the Ministry, said that he could assure the Council that the object *Mr. Roberts* had in view in moving this resolution was one which had the fullest sympathy of the Ministry, and that the Department would certainly do what it could to meet the Council's wishes.

The motion was then put to the meeting and carried.

Unemployment Insurance.—*Mr. Denton Woodhead* moved :—

"That this Council considers that if agricultural workers are to be insured against unemployment, it should be done under a scheme applicable to the agricultural industry only, and not under the general scheme for all workers."

He said he understood that the question of preparing a Bill for agricultural unemployment insurance was now under consideration by the Government. He thought it was clear that Agriculture would not agree to being insured under the general scheme. There was a debit balance under that scheme of over 35 million pounds and, for one thing, agricultural workers did not wish to take any share of that. Furthermore, agricultural workers could not pay 7d. a week. He was a member of the Departmental Committee that went into the figures, and concluded that if the employer paid 1½d. and the worker 1½d., the State coming in with another 3d., the funds provided would be ample. The Treasury would have to find less than half a million. Further, the scheme should be managed by the industry itself; and he suggested an equal number of workers and employers sitting together. *Mr. Woodhead* then went into figures of possible adminis-

tration, which he thought would in time give an ample reserve, after which the industry could do without contributions from the Government and the workers, and run the scheme with a small contribution from the employers. *Mr. H. W. Thomas* seconded the motion. *Mr. W. Holmes* said he must vote against the resolution as *Mr. Woodhead* had explained it. He agreed with a special scheme for the industry, but not that it should be taken away from Government management. Workers on the land were already pouring into other industries. He thought that the Ministry of Agriculture should have the control.

Replying on behalf of the Ministry, *Dr. Addison* said that the Ministries of Labour and Agriculture had been examining this subject closely for some time. The Government realized that any contribution which might be asked from the industry must be one which must take into account not only ability to pay, but also the lower incidence of unemployment in agriculture, if that existed. The various factors would be taken into consideration.

The motion was put to the meeting and carried.

APPENDIX

REPORT OF THE STANDING COMMITTEE ON THE MARKETING OF WHEAT, BARLEY, AND OATS

(1) In continuation of the series of short reports on the marketing of various agricultural commodities, we now issue this report on the marketing of wheat, barley, and oats. The investigation work which we have undertaken in connexion with it has been assisted very considerably by the issue by the Ministry of its comprehensive report on the same subject.* We have interviewed various experts on the production and the wholesale distribution of grain and flour, and other people with special knowledge of the industry, so that our report will be found to follow its own lines and come to its own conclusions. At the same time, we would recommend anyone wishing to examine the subject in greater detail to study the Ministry's most valuable survey.

(2) In our interim report of January 19, 1928, when we covered in a general way the whole field of agricultural marketing, we recommended that the farmer should be protected from the position of being forced to sell his wheat immediately after harvest, if by keeping it he could obtain a better price later in the season. The question we discussed then was mainly one of finance, and since that report, the Agricultural Credits Act, 1928, has been passed, and the farmer is now placed in a position to borrow money on the security of his growing or stored crops and therefore to hold his grain as long as he wishes to do so. The question, therefore, now narrows down to the more direct economic one: does it usually pay the farmer to dispose of his wheat in early autumn, or should he keep it till the following spring or later, bearing in mind that there is a loss in quantity and weight of crop through drying in the stack, and loss by weather damage, mould and vermin (which is largely preventable) as well as loss by

* Economic Series No. 18. price 6d. net.

way of interest on his money had he sold? We shall consider that question in the course of this report.

(3) We shall also consider the question of improving cereal marketing by standardization and grading of produce as well as the separate question of improving the quality of production. The possibility of improvement by tariff reform, or by dealing with cereal imports through an Imports Board, are not matters for a report of this kind, the object of which is to consider marketing and allied subjects in relation to general conditions as they exist at present. With regard to the proposal to institute a Wheat Imports Board, it may be mentioned that we made an Interim Report on Wheat Marketing dealing solely with this question, under date June 1, 1928, in which we stated our view that, so far as the British farmer was concerned, the suggestion was one worthy of serious consideration by the Government. This seems to us especially so at the present time in view of the imports of German wheat and oats which are, in effect, bounty fed and which undersell home-grown grain on our home markets.

(4) We have limited ourselves, therefore, to the question of improving the marketing of grain by the better organization of the industry concerned. The subject divides itself into three sections. First, the improvement of varieties of strains of wheat, barley and oats, so that a better quality and more weight of grain are obtained to the acre. Second, standardization of production, so that larger total quantities of the same kind of wheat, barley, or oats, may be grown and graded for sale, and the demand for home-grown grain and flour in bulk improved. Third, the improvement of other parts of the technique of marketing, including the selling at the best time of year to secure the best price, and the marketing of cereals by farmers in combination under a definite plan whereby whatever time of year a farmer sells, he gets the appropriate price for his quality of grain.

(5) In addition, there is the possibility of creating a larger and better market for home-grown wheat by such means as requiring a definite percentage of home-grown flour to be used in bread, or by placing a limit on the water content of the loaf. We propose, also, to discuss these in this report.

(6) As regards improvements in varieties of wheat, barley, and oats, commonly grown in this country, the Plant Breeding Institute at Cambridge, the Home-Grown Wheat Committee, and other Institutions and persons have, in recent years, been the means of producing new strains and varieties which promise well. For example, Yeoman and Yeoman II, new varieties of wheat, while not giving greater yields on all soils, are recognized as giving better bread-making flour than the older varieties. They contain more "strength" or capacity to stand up to fermentation and to absorb moisture, which is the valued baking characteristic of the Manitobas and certain other strong wheats from overseas, which will turn out more loaves to the sack than will the softer wheats and are, therefore, in more demand by bakers. But the better flavour of the good English bread-making flours should now be taken into consideration as well as their improved output of loaves per sack, and bakers and the public should realize that good presentable loaves, comparable in many respects with those made from flour from overseas wheat, can be made from Yeoman II wheat flour entirely; and, further, that ordinary English flour can be used with advantage to a greater extent than is usual in mixtures of flour for bread-making.

(7) If a farmer grows Yeoman wheat, however, it does not follow at all that he will get Manitoba price for it, or anywhere near it. The price of Manitoba No. 1 or No. 2 may be 13s. a cwt. and the corresponding price of good English wheat 11s. a cwt. That broadly answers

the question of why it is that larger areas are not sown with this best bread-making variety of wheat. The farmer knows by experience, in the present state of marketing, that it pays him to get the biggest bulk of crop, irrespective of bread-making quality, because the market does not pay much attention to quality differences except where dirty and uneven samples are concerned. He therefore almost invariably sows the wheat which he knows will crop well on his particular land. His knowledge, and sometimes experience, of costly failures in sowing new wheats makes him shy of trying varieties when he does not know how they are likely to crop on his particular class of soil. In the absence of any marked price difference, therefore, he usually only changes his variety when the old one for some unexplained reason fails him, as all kinds are likely to fail after several years' growth on the same soil. It may be taken that why he does not, in such a "change over," invariably try Yeoman II is that he knows that the market will not recognize, to an extent commensurate with his risk of a poorer crop, the superior quality of the resultant produce.

(8) The remedy seems to be combination of farmers' associations with representatives of the flour milling industry and the bakers to secure a proper appreciation by the public of the value of the better English flours as bread makers. The Ministry's Report (p. 161) states that:—

"The quality of the cereals grown in this country ranks high. Our wheat is good. Compared with the average product from abroad it is cleaner, sweeter, and more palatable. It is free from insect pests, such as weevils, and yields a high percentage of flour of first-class colour and flavour. Nevertheless . . . the average price of imported wheat is higher than that of the home product."

That being so, it should not be difficult to adjust the position in favour of English flour if the public will only take a hand in the matter. Much English flour is good for bread-making and it can be improved still further. The country miller can mill it satisfactorily, and the baker, where he is willing to study the characteristics of the flour, can bake it properly. The result should be a loaf which an appreciative public will much prefer to that made from one or other of the ordinary bread-making flours of commerce. Such bread from English flour which had been grown, milled, and baked locally, should become highly valued not only on account of its flavour, but from the fact that it is produced as economically as possible; no waste in transport or manufacturing costs, those engaged in the business of producing it being able to get the best possible price for their produce, whilst those consuming it would pay no more than a fair and reasonable price for it. It is submitted that an organized selling policy such as this is necessary for English flour, in view of the way it is now quite undeservedly pushed into the background as regards bread-making use, favour with bakers and the public, and price.

(9) On the other side of the picture, it is to be stated that there are too many varieties of wheat grown in this country. From a selling point of view, it is clearly an advantage for as many farmers as possible to grow one good yielding wheat whose produce can be bulked and sold in quantity for the best price. At present, farmers grow any and every kind of wheat, and sell it in small individual parcels, mostly direct to the country miller or merchant. The practice of all the farmers in a district growing one variety is followed in Canada, where it is possible, owing to similar conditions of soil and climate, for huge areas to be given over entirely to the same wheat. There, after harvest, each man's wheat is graded in accordance with Government Acts and Regulations and placed eventually in one or other

of the large elevators for bulk sale, the farmer being paid a substantial instalment of its value at once. While this ideal of uniformity of grain cannot be followed in this country, where conditions are admittedly very different, some reduction in number of varieties could undoubtedly be made as part of a national better marketing programme for wheat.

(10) We understand that the Ministry of Agriculture has now put forward the suggestion of the National Institute of Agricultural Botany that one or other of the following varieties of wheat should be found suitable at the present time in nearly all districts in the country : Yeoman II, Square Head's Master, Weibull's Standard, Little Joss, Iron III, and Wilhelmina.

For barley, the recommended varieties are : Spratt Archer, Plumage Archer, Archer, and Archer Goldthorpe.

For oats, those recommended are : Black Winter, Bountiful, Victory, Golden Rain, Thousand Dollar, Abundance, and Grey Winter.

We do not, however, recommend that this list should be adhered to too literally as there are other varieties which are known to give excellent results in certain districts. The important thing it seems to us is to discover which variety suits a certain district best, and then to advise its extensive use therein.

(11) In Canada, all new varieties have to be licensed for sale as being not only new, but of good quality. Without a licence they cannot be sold. In this country new varieties can be brought out at any time. These are sold mostly on the farmer's second-hand knowledge of results. Without wishing to detract from the merits of this plan, which, under the private initiative of seedsmen, has been the means of bringing several new and valuable varieties into being, it must be observed that some new varieties are frequently not up to the standard of existing ones of the same class, while others occasionally are only selected seed of older varieties under a new name. For this reason, many farmers never go in for new varieties, but, when they need fresh seed, buy some of a well-known strain or variety from a neighbouring farmer or seedsman.

(12) The Seeds Act, 1920, and the Seeds Regulations, 1922, require the seller, in the case of all sales of seed wheat, barley or oats, to state in writing, among other facts, the germination percentage of the seed. The necessary certificate as to this is obtained from the Official Seed Testing Station, Huntingdon Road, Cambridge, on sending a sample of at least 4 oz. of seed and paying the fee of 2s. That is some protection for the farmer against poor seed, but in the case of varieties submitted by growers who take them to be new it seems to us that the test should be more lengthy and detailed, covering one or more growing seasons, so that the certificate issued can vouch for the fact that the variety is what it claims to be, really new, and is also a good variety of promise for certain specified purposes. It must be remembered that much higher prices are charged for new varieties of seed of promise, and it is suggested that these should only be sold when they are what they are represented to be. This suggestion involves the setting up of a Synonyms Committee for cereals such as already exists in the case of new varieties of potatoes. We understand that this matter is already under consideration by the National Institute of Agricultural Botany. In the case of potatoes there is no law requiring that new varieties shall pass the Committee's tests, but growers and the Trade readily accept the tests as final, and do not accept any variety as new which has not passed the tests. It may be possible to do the same thing in regard to cereals.

(13) We need not here refer to the obvious advantage which a farmer has in growing wheat which is free from the admixture of

weed seeds, or the seed of other varieties, or from bunt or smut, and is up to full germinating capacity. To assure himself on these points, he can, quite apart from the Seeds Act Regulations named above, get samples of his own farm-grown seed examined at the National Institute of Agricultural Botany, Cambridge, on payment of a small fee.

(14) As regards the larger question of standardization of wheat—apart from the reduction in and improvement of the varieties grown which, in due course, will assist such standardization—we consider that substantial advance may be made by securing the recognition of a “fair average quality” for the chief types of British wheat on the markets in each individual year. Australian wheat is sold in this country according to a sample of the year’s crop, which is recognized by the representatives of millers and buyers as “fair average quality,” and the sample is kept in the office of the London Corn Trade Association. Wheat of a better quality than the particular year’s sample is paid for at a higher price, and vice versa. That method serves to secure a quality standard for wheat, and, what is much more important, a certain uniformity of price. If British wheat could be sold in the markets of this country on the basis of a “fair average quality” standard, it is thought that better prices would be secured on that account alone.

(15) We have considered the question of a more definite method of selling, viz., by grade definitions, governed by certificate of weight per bushel, moisture content, condition as to damage, and freedom from weed and other wheat seeds, as is adopted in Canada and the United States, but we think that this would be too advanced a method for the present state of our development. We have too many varieties and qualities of grain, and, on the whole, sale by “fair average quality” seems to be the suitable mean course which should be adopted. As to establishing “fair average quality” for certain grades, red and white, etc., for any particular district and season, that should not present great difficulty and could be done by a small committee of experts working on behalf of buyers and sellers soon after harvest.

(16) As regards standardization of flour, we are very glad to note that the Ministry of Agriculture has recently come to an agreement with the milling interests of the country to mill and sell under the National Mark voluntary scheme All-English flour of three specified grades, viz.: (1) All-English (Plain), to comprise all the flours obtainable from wheat, provided that the ash content, as ascertained in a certain way, is not more than .55 per cent. by weight of the total flour. It is to be sound, free from taint or objectionable flavour, of good keeping quality and unbleached by artificial means, and with no added chemical substances. (2) All-English (Self-raising), which is to be the same as (1) except that it may contain such ingredients as may be required to make the flour self-raising, subject to the Regulations for the time being in force under the Bread Acts Amendment Act, 1922. (3) All-English (Yeoman), which is also to be the same as (1) except that it must be Yeoman. These grades came into force on October 1, and it is possible now for consumers to be certain that where they buy flour as “All-English” it is such. These facilities, if fully used by housewives and bakers, should do much to increase the demand for the flour of home-grown wheat, and so benefit our chief home industry. Bakers in particular, in order to give their customers the best possible quality of bread, can usefully advertise that they propose in future to use a stated percentage of the best English flour in making their daily “batch” of bread. They can also push the sale of the All-English flours for domestic use, including domestic bread-making with All-English (Yeoman).

(17) The next question—as to the time of year it is best for the farmer to market his wheat—must always be difficult, and, in different years, with the inevitable seasonal changes that take place in the world's wheat position and prices which cannot be foreseen, the answer must frequently be a different one. There are, however, certain stable factors in the situation which should be understood. First, there is a considerable thrashing of wheat in the Lincolnshire-Cambridge area immediately after harvest where straw is required for the potato clamps and other purposes. This wheat is not usually stored as grain, but is put upon the market at once. Much of it comes to London and to the other chief markets in the eastern counties, and there meets wheats which have likewise been thrashed immediately after harvest for other reasons perhaps than the need for straw. The same operation goes on in other parts of the country, and wheat is rushed upon the market without sufficient consideration of the total effect upon price, and price is undoubtedly depressed in consequence. We need not bring into consideration the position as regards imports in the autumn; that is very variable and may or may not tend further to depress British wheat prices at that time. It will suffice perhaps to say that, in the opinion of experts, the price of home-grown wheat is certainly less than it would otherwise be in the autumn because of the glut of it on the market.

(18) According to the Ministry's Report, the average price of wheat sold September to December in five recent years is 11s. per cwt., and from January to August is nearly 12s. per cwt. The figures do not show that the reward for holding wheat for a few months is likely to be very well worth while, especially when it is remembered that stack-stored grain suffers from vermin, mould and other damage, from lightening and drying in the stack, and that the farmer stands out of his money and at least loses the interest on it by keeping his wheat. The total loss in weight of grain from all causes is put by the Ministry's Report at about 10 per cent. in a normal year if wheat is kept till April. If grain were thrashed at once after harvest and stored in an elevator or silo, specially built for the purpose, we do not find that the selling position for the grower would be likely to be improved, as the cost of transport and keeping in condition in the silo, together with the almost inevitable reduction in weight of grain would probably out-weigh any other advantage of this method, such as the absence of loss by vermin, etc., which would occur by keeping wheat in the stack. Where wheat is to be kept at all under present conditions of marketing, it seems to us that it is best kept on the farm in the stack.

(19) If the position is changed by the introduction of a new national programme of better-marketing such as we suggest, then it will probably be essential to hold some grain in silo or store so as to "even out" the supply through the season, and be ready to meet any increased demands from the millers to buy at higher prices. Should it be possible for the State to help on the scheme by giving free storage of grain, that would be most useful and acceptable, for although elevator storage would hardly repay the farmer's outlay and upkeep, it would, as a means of conserving national supplies of grain, be a boon to farming as well as a service to the nation.

(20) These remarks perhaps suffice to show the principal difficulties in the way of the farmer making the best decision as to the time for marketing his wheat. He may, in a year of world rising prices, be lucky and sell well if he keeps to the end of it. He will nearly always get a better price later on if he keeps it, but will it be such as to cover the loss in quantity, and interest on the money? It seems to us to be in the nature of a gamble, and that the only proper solution is the combination of all wheat-growing farmers in a system of arranged

and orderly marketing. It is obviously unthinkable that farmers will be satisfied to continue longer the present haphazard method, or want of method, of rushing a large part of their wheat on the market in the autumn and so depressing prices, not only for that time but for later months, because it is always difficult, once prices have been unduly depressed, to get them back again to a fair level. Further, the contract prices for English flour for the season are based on the early season's wheat prices, and this undoubtedly tends to keep down prices for the remainder of the season.

(21) In our view, then, the autumn price depression is to some extent responsible for the poor prices for English wheat throughout the whole year, and we think it can be avoided by a scheme of orderly marketing such as is suggested. Going hand in hand with the scheme would be a plan of reduction in the number of varieties and sale by fair average quality so as to increase the chances of large bulk sales of the same grade wheat to the port mills for the purpose of meeting the town demand which should arise for a loaf made wholly or partly from English flour, and general propaganda as to the value of the English loaf. The total increased demand for English wheat thus obtained, helped by that from the Ministry's scheme of selling All-English flour under the National Mark, should do a great deal to improve the selling position of English wheat.

(22) The difficulty, at this point in our summary, is to indicate the lines which a sound scheme of orderly marketing should follow. A farmer, if he came into a scheme, ought to be ready to surrender his right to sell when he pleased. His sales ought to be governed by a central selling organization, and the price to the farmer graded according to the time of selling and final instalments paid at the end of the season. A farmer should be paid according to the quality of his wheat estimated on f.a.q. basis, and according to the time at which it was sold. Obviously, if he keeps his wheat in the stack longer, he should be paid a higher price for that service. Such an averaging system worked by a pool seems to us to be the only fair and certain method of securing to the farmer his equitable price whilst at the same time ensuring that wheat will be held off the market in autumn. The suggestion, however, involves too many complications, and, moreover, would not fit in with our existing and well-established marketing methods. It is true that the representative of the pool might offer the farmer's wheat to miller, merchant or factor on the market place, in the same way as the farmer now offers it himself, but such a change would be likely to make the market too precarious to be long continued. It is certainly advisable that the number of sellers of wheat should be reduced, but to suggest their reduction to a single individual would hardly be acceptable to the buyers. It seems to us that an intermediate course can be suggested, and that is to set up area selling organizations as put forward in the Ministry's Report. The selling of each organization would be controlled by a committee of members, and the associations would sell against one another in the local markets. They could arrange their business as they wished, either paying the farmer the price his wheat actually fetched at the time he was ready to sell it—provided, of course, that the selling of it at that time did not conflict with their agreed better-marketing policy—or by "taking charge," selling it for him, and paying him the graduated average price as worked out at the end of the season in some such way as above suggested for the pool. Such a course would secure a diminution in the number of sellers and would prevent the usual autumn glut and consequential serious depression in prices. To be successful, it would need the strong support of all agricultural bodies, as well as that of as many individual farmers

as possible. Farmers who stood outside an area organization, and sold their wheat against it and others in the market, would be unlikely to find over a series of years that their operations had been so successful as those of farmers who had joined the organization.

(23) There is not much that we wish to say on the present distribution of markets. A few of the smaller ones seem ineffective for the farmers' purpose of getting the best price for the day, but these will probably die a natural death, as some already have done, as soon as the position is fully realized.

(24) From the evidence which has come before us, we have formed the opinion that the methods of marketing adopted by merchants and factors are in themselves and as a rule efficient. We have heard no complaints as to the extent of the margins taken, and we have reason to believe that many merchants work on small ones. On the whole, the merchants and factors have given their best services under the circumstances that have prevailed in the past. We are, however, of opinion that the time has come for improving the marketing of English wheat in some such way as is indicated above, and that this may mean, when an improved system is fully operative, a reduction in the number of merchants and factors now in the business.

(25) As regards the question of the feasibility of a requirement that bakers should use a stated percentage of British flour in bread, we have considered it and agree that there are great difficulties in the way of operating a scheme of the kind in present circumstances. If a plan of even-sharing of supplies could be worked out and sufficient English flour be forthcoming to provide a definite minimum percentage in the loaf, then we would like to see the position further explored.

(26) So far as the other suggestion, to increase the demand for English flour indirectly by limiting the water content of bread through the amount used in the dough is concerned, that seems to us to be a much more promising field. English wheat naturally contains more moisture than hard foreign wheat, though it is usually of superior flavour. It is not used for bread-making so much as it might be because it will not absorb so much additional moisture as Canadian and will not usually bake so well into a light fine-textured loaf. Some 96 loaves can ordinarily be got out of a sack of everyday bakers' flour which is composed largely of Manitoba, whilst only 88 to 90 loaves can usually be got out of a sack of average English. English is known to have special merits as regards flavour, and we suggest that it should at least be more freely mixed with Manitoba. This would be helped by limiting the advantage of Manitoba and other strong wheats—arising from their capacity to absorb water and thus becoming attenuated into more loaves—by fixing a maximum limit for water content. The Ministry's Report suggests 35 per cent. in white bread and 40 per cent. in brown. With such a limitation, the quality of the loaf also would tend to improve. The whole matter is, however, a technical question on which we do not pretend to be able to advise authoritatively. We merely single it out as meriting special consideration from the point of view we have in mind, which is to increase the use and credit of English flour in bread-making. The question of the need for the use of bleaching and other chemical substances in certain flours might also be considered, and if it is shown that these are necessary to the sale of certain foreign flours and not to that of English, their use might be limited to a minimum, if not prohibited altogether. We suggest that the Ministries of Health and Agriculture should be asked to set up a joint departmental committee of experts to consider these questions with a view to any necessary legislation being introduced.

(27) In the above survey we have dealt almost entirely with wheat, but there are certain special problems of barley and oats which deserve consideration. Our remarks as to reduction in number of varieties, improvement in quality of seed, standardization of grain and flour, and farmers' combination for selling apply equally to these other two cereals. Malting barley will, however, always be sold per parcel on its sample merits, though it may be possible for farmers' organizations to match it up into larger parcels for the big brewers and so receive better prices for bulk. It would be an advantage if the number of sellers of good malting barley were reduced, and that the superiority of the malting qualities of the best British barley over those of foreign imports were as well understood by the sellers of barley as by the buyers. It is suggested also that as a matter of patriotic action, apart from motives of interest, maltsters, brewers and distillers should be prevailed upon to buy English barleys to the limit of the reliable supply for the purpose of making malt. The prices of beer and spirits do not vary with the price of barley, and it is suggested that brewers and distillers can well afford to assist agriculture by supplying their wants in regard to malting barleys, as some of them already do, from the crops grown in their own country.

(28) There seems to be very good reason why malting barley intended for use in malt flours and malt extracts should be graded and sold to the manufacturers of these products as "all-English." We are informed by the Ministry that members of the Association of Malt Produce Manufacturers are ready to buy English malted barley to the extent of at least 50,000 quarters if it is graded and guaranteed under the National Mark scheme. We understand also that the Ministry of Agriculture and the National Farmers' Union are quite prepared to co-operate in a scheme for grading and marking these products under the Agricultural Produce (Grading and Marking) Act. It will probably be possible by December 1 next to approve packers and to authorize the National Marking of these products. The public should be at once advised of the position and asked to "do its bit" by buying only malt flours and extracts which are guaranteed under the National Mark.

(29) Home-grown feeding wheat, barley, and oats are sought after by poultry keepers and other live-stock feeders as amongst the best rearing and fattening feeds, and they are, for this purpose, well in advance of imported produce. It is always a question for the farmer under present conditions, when the demand for grain for this purpose is strong, whether his best price for wheat is not to be obtained through sale as poultry food. It would certainly improve and stabilize prices if feeding barleys and oats were also sold on a f.a.q. basis as is suggested in the case of wheat.

(30) In the case of oats, it has always to be remembered that no imported feeding oats are of as good a quality as the best of the oats grown in this country. That does not mean that the crop cannot be improved. By a system of reducing varieties, growing only "pure line" seed, and paying increased attention to methods of cultivation, it is possible, not only to produce larger yields per acre, but better quality produce. Since home-grown oats and their products—oatmeal, etc.—come into direct competition with similar imported products, it would be advisable, in view of their outstanding qualities, to prepare a scheme by which the home-grown produce can be at once identified. We do not at once see how a National Mark scheme could be used in the case of the grain itself, though it can and should be used in the case of oatmeal put up into bags or packages. We hope that the Ministry of Agriculture will give early attention to this subject as it is important that our own home produce should not suffer from imports

of grain, the export of which from the country of origin is financially assisted by tariff rebates, bounties or subsidies, or any such arrangements.

(31) Our chief recommendations are :—

- (1) Limitation of numbers of varieties of wheat, barley, and oats grown in this country.
- (2) Limitation of new varieties of seed allowed to be put upon the market. This involves several years' preparation by a Synonyms Committee, which will be set up to work in conjunction with the existing Plant Breeding stations in the country.
- (3) Sale of wheat, feeding barley, and oats on a "fair average quality" basis, and the conservation of the year's crop throughout the year in such manner that its sale brings the best available price to farmers, and a more or less even distribution throughout the year.
- (4) A propaganda campaign carrying to the British public the information that home-grown wheat and flour for bread-making, malting barley for malt, malt flour and malt extracts, and home-grown oats for feeding are the best to be obtained. This might usefully be directed by the Empire Marketing Board, which has already acquired considerable experience in such matters. It will be complementary and not antagonistic to the business of advertising other cereal produce. It should be possible to supply all the cereal needs of this country from grain grown within the Empire. At the same time, all bakers should be asked to inform their customers of the percentage of home-grown flour which they ordinarily use in making bread, and those using a proportion of English and the rest Dominion should be commended and recommended.
- (5) Farmers should combine in associations for the purposes of (1), (2) and (3), and especially for the purpose of the sale of bulked grain, and representatives of these associations should confer with those of the flour-milling industry and bakers to work out a plan mutually acceptable for the purpose of the better selling of English flour for bread.
- (6) The Government should make provision for storage for home-grown grain, as its contribution to a farmers' scheme of more orderly marketing on the lines we have suggested.
- (7) The Government should consider the question of setting up a departmental committee as proposed in paragraph 26 to consider the feasibility of requiring a maximum moisture content for bread, and as to the need for the use of bleaching and other chemicals in flours.

October 10, 1929.

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DECEMBER ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A.,

County Agricultural Organizer for Derbyshire.

Weather Notes.—During the winter months, commencing about November and ending in March, the gradation of temperature is from west to east rather than northwards. The climate of Ireland and the western half of Great Britain, including the north-west of Scotland, is appreciably warmer in the day than that of the eastern counties of England; and the difference in the night temperatures is even greater. The map-lines indicating the amount of rainfall follow much the same direction as those for temperature: the western districts are wetter than the eastern as well as milder in winter.

The above indicated differences, due to the influence of the Gulf Stream and the direction of the prevailing winds, are continued across the continent of Europe. Parts of Denmark and Germany are ice-bound during the greater part of the winter; while farther east the average winter temperature is many degrees below freezing point—and there, apart from the comparatively light falls of snow, no moisture is precipitated from the atmosphere until the return of spring.

The above climatic differences have an influence on crops and agricultural practice in different areas. The mid-European farmer must husband autumn rains more carefully and sow his winter cereals earlier than is necessary in England; and he must house his pigs and cattle more warmly in winter than is requisite here. Winter corn, grass and grass-like weeds continue to grow almost throughout the winter in our western counties, whereas the mean temperature on the eastern side of the country falls below growing point, 40 degrees, about the middle of December. The suppression of twitch and couch in arable land is obviously more difficult in, say, Somerset or Glamorgan, where it continues to grow in winter, than in Lincolnshire or Norfolk, where it can be repressed by exposure and repeated stirrings in the dead season. The keener frosts of the east favour tilth production, and the drier conditions permit of field work on a greater number of winter days and earlier cultivation operations in spring. These differences play a part in determining the proportions of arable and permanent grass in the farming systems of the two sides of the country.

Field Operations.—December is not a good sowing month. Occasionally fine crops of wheat and winter oats are grown

from seed put in at this time of the year, the results being due to the coincidence of a set of favourable conditions—a mild winter, well-drained soil and high condition; but in most districts and years, seeding operations may best be suspended for about a month in December and January. Apart from the very slow germination and growth made at the low temperatures usually prevailing about this period, birds levy a heavy toll on the seed and seedlings just appearing through the ground.

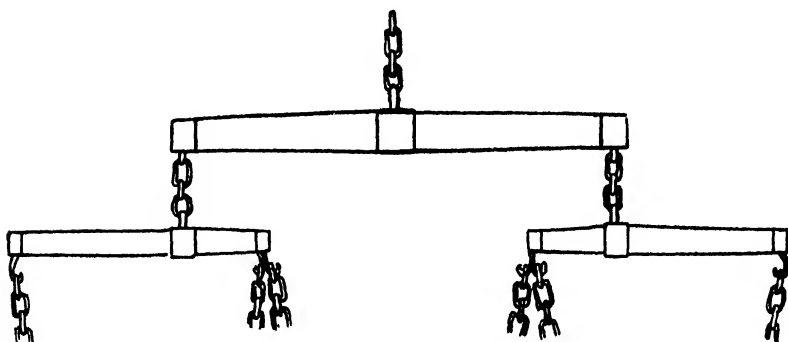
Ploughing continues in December, particularly on land recently cleared of cabbage, kale and turnips. The manuring and ploughing of stubbles intended for roots next year should also be completed by the end of the month if possible. Stubbles definitely intended for bare fallowing, if not already sown with rye-grass as previously suggested, may now be best left till about April, to avoid the pulverizing effects of frosts, which are not helpful for the purpose here intended.

On farms where cattle are kept in byres, the ideal of leading out and spreading the manure daily may not be wholly attainable in the wet spells; during frost, however, an opportunity occurs to empty the yard of manure that may have accumulated. The meadow land may receive some, but where the supply of dung is not equal to the requirements of both the arable and the meadow land, the latter can quite well be treated with artificials only, in order to meet the more urgent need for organic matter on arable land. In some arable districts the whole of the dung is applied to the seeds stubbles just before ploughing for wheat. In the light of experiments, it would seem desirable to apply at least part of the dressing to the maiden seeds in winter, especially where clover is the principal constituent of the ley mixture: red clover responds well to dung.

Multiple Horse Teams.—Messrs. Amos and Garton, in their interesting report on farming methods in Australasia and Canada, make frequent reference to the greater output per man obtained in these countries by the adoption of larger and faster teams and wider implements than are commonly used in this country. With the smaller fields and less specialized farming pursued in Britain it would be difficult to adopt colonial methods here, and Messrs. Amos and Garton do not include the six-horse team in their list of recommendations to British farmers. There is no doubt, however, that our standard performance of about an acre of ploughing per day is too low for the costs and prices prevailing to-day, and the

higher output obtainable by using the double-furrow plough and the three-horse team could be secured more extensively than is yet common.

The working of three horses abreast is often advantageous even where the draught of the plough is too great to allow of the adoption of the double furrow. The extra horse permits of a better pace and perhaps a wider furrow. In this connexion mention may be made of a simpler arrangement of whippletrees than that of the cumbrous five-piece outfit: this is a device with only three timbers, the middle horse being hitched



A Simple Three-horse Hitch.

to the inner ends of the two outer horses' whippetrees, the draught being evened by placing the fulcrums of the latter one-third of the length from their inner ends. The theoretical objection to this design is that it does not permit of simple adjustment to compensate the different strengths of the three horses in the team, but this does not outweigh the great practical advantages of the device.

Live Stock Matters.—This winter many herds of cattle, young stock as well as dairy cows, are being rationed on much reduced supplies of hay, the place of this fodder being taken by concentrates, wet grains, straw, beet pulp and additional roots where available. No doubt the dairy herd will receive preference in supplies, as the consequences of under-feeding are more quickly felt through the milk account; but in this matter the farmer who rations his young cattle with strict economy may support his practice with the results of experiments, which prove that liberal feeding in winter is not so conducive to rapid summer-growth as is a lower plane of winter rationing—it is natural for young cattle to endure some hardship in winter.

There is one important difference between hay and the above-mentioned substitutes : hay, especially that grown on good land, supplies mineral matter, particularly lime, which is so important for the good health and breeding properties of animals and which is very deficient in straw and concentrated foods. A daily allowance of 20lb. of good hay furnishes the animal with about 6oz. of calcium carbonate. In the light of the above fact, and in the endeavour to apply the results of recent experiments on the addition of mineral salts to foods deficient in lime, it seems desirable to feed minerals with the various materials that are being offered to stock in place of part of their normal hay ration. For some years the writer has been associated with informal experiments in which cattle have received a daily allowance of equal parts of limestone flour, sterilized bone flour and salt, fed at the rate of 3lb. per 100lb. of concentrates. This year many Derbyshire farmers are feeding a mineral mixture, of which the principal constituents are the three above named, at the rate of about 4oz. per cow per day.

Poultry Items.—Days are short in December and the hours of daylight during which fowls may forage and feed are so reduced that heavy layers are usually unable to take up all the nutriment they could utilize. Numerous experiments have shown that, under the conditions of the trials, improved output of eggs in winter can be secured by the installation of artificial lighting arrangements whereby the pullets are enabled to eat an additional allowance of food either late in the evening or early in the morning. It is not yet proved to the writer's satisfaction, however, that the desired extra nourishment cannot be taken up without artificial lighting and an additional feed ; the alternative of making the ration more concentrated as the days shorten is simpler and would probably compare favourably with the more expensive expedient.

To make the ration more concentrated the bulky foods such as bran, clover meal, oats and sharps should be reduced, and the richer foods, maize meal and wheat, increased ; the protein reduction thus incurred should be compensated by increasing the proportion of fish meal or high-grade meat and bone meal. Sufficient but not excess of green food must be supplied. In this way the 4oz. or so of food that the bird can consume in the day is made to supply about 20 per cent. more nutriment. One would not recommend such a strong ration for hens of inferior laying capacity or for summer feeding with hoppers always open.

NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,

Rothamsted Experimental Station.

Liming Experiments.—Although much is written about the need for lime on agricultural soils a glance through the publications of experimental farms and county councils shows that there have been far fewer experiments with this material than with nitrogen, phosphoric acid and potash.

The best known arable experiment with lime is that on barley at Woburn, where the correction of the acidity arising from the yearly use of sulphate of ammonia is demonstrated. Without lime there was practically no crop. One ton of burnt lime applied twice in 21 years served to bring the crop up to the level produced by nitrate of soda.

In such pronounced cases, experiment is hardly necessary in practice to demonstrate that a dressing of lime is required. The well-known signs of acidity will be so marked that the cause of crop failure is clear. This has repeatedly been put on record for sugar beet, barley and red clover. Where these crops have failed, either over whole areas or in patches, analysis frequently reveals a shortage of lime, and the application of lime has brought the land back into cropping. Usually, however, the conditions are not quite so definite. It is not certain whether lime is required to grow maximum crops or whether if applied it will give a profitable return on the outlay. It must be admitted that experiments on these lines are relatively few.

A number of experiments in which $1\frac{1}{2}$ tons of burnt lime and 3 tons of ground limestone were compared under rotation cropping on various Irish soils have recently been summarized in respect of the results of the third, fourth and fifth seasons after liming.* The two forms of lime were on the whole equivalent in their effects, which were in most cases observable for the five seasons. Out of 10 centres in their fourth year, 8 gave better crops when lime had been given. Of 15 centres in their third year, 12 were in grain crops (usually oats) and gave increases due to liming in every case, the average being $3\frac{1}{2}$ cwt. per acre. Potatoes were only slightly benefited if at all. At two centres the grain yields were approximately doubled by the lime application, the limestone doing equally well. The conclusions were that except in a few special cases the crop increases following the application of lime were small and continuous rather than marked or immediate. The experiments

* *Jour. Dept. Lands and Agric.*, Dublin, 1929, Vol. XXVIII, p. 160.

extended over a number of different soils, but the connexion between type of soil and need for lime was not clear, and every case should in practice be examined individually. These conclusions are in agreement with English experience, where, except in cases of pronounced deficiency, liming is to be regarded as an investment which yields a moderate interest over a period rather than a large return in the first years.

Experiments on special effects of liming have been made from time to time. Professor Hendrick at Aberdeen has investigated the action of lime in controlling finger-and-toe disease of turnips, and found that if sufficient lime or chalk was added to render the soil neutral the disease was very considerably reduced even under the most exacting conditions. A further valuable effect on heavy soils is the reduction of the draught of ploughs which results from the chalking of land. This has been shown at Rothamsted to amount in certain cases to 11 per cent., and the effect persists for a long period of years.

On grassland the action of lime has not been so beneficial as on the arable. Only in extreme cases has its use been justified. The best known experiment is at Rothamsted where the classical hay plots are cross dressed with 2,000 lb. of lime per acre every four years. The most striking effect here is the benefit of lime on plots which were very acid through the continued use of heavy dressings of sulphate of ammonia on land originally poor in chalk. This result has a definite bearing on the intensive grazing system in which successive dressings of sulphate of ammonia are used under rotational stocking.

On certain matted, acid pastures derived from the coal measures and Millstone grit in Yorkshire, liming has been found to be the first essential of improvement. Under its influence the mat disappears, clover increases, and the herbage is closely grazed by stock. After this preliminary treatment the improved turf will usually further respond to phosphate. On the majority of grasslands, however, basic slag is sufficient, and itself supplies an appreciable amount of lime. Thus, on the well-known Tree Field at Cockle Park lime added to slag produced no further live weight increase. In a series of demonstrations with basic slag and lime on acid pastures in the west country, slag did all that was required and there was no immediate effect from liming. Nevertheless, in some cases the limed plots showed up after a period of years. This delayed action of lime has been observed elsewhere. These results are in general agreement with similar experiments carried out in Ireland in 1925-28, when out of 40 centres only 4 or 5 showed an

appreciable improvement for liming in the third year, and in any case the effect of phosphate was more rapid and more marked.

Complete Manures.—In recent years attention has turned to the production of a range of mixed fertilizers containing unusually high proportions of nitrogen, phosphoric acid and potash. This is particularly the case in Germany where the bulk of the trade is still in the form of separate artificials, but the new complete manures are gaining ground. In England large quantities of factory-mixed fertilizers are sold in addition to the individual constituents. In the United States a very high proportion of the total plant food is sent out as mixtures. The case for and against mixed manures is often debated. There are two distinct questions. First, if a mixture of fertilizers is to be used shall it be made at home or bought ready-made from the factory? Secondly, is it best for the cultivator to give a complete dressing of a more or less standard type, or shall he rely on his judgment and apply a manure definitely made up to suit the circumstances in question?

As far as the first point is concerned it is largely a matter of convenience. In the United States the necessity of providing labour to make farm mixtures acts decisively against the purchase of the simple fertilizer salts. This consideration also operates here among certain users of large quantities of artificials, as for example in potato-growing districts. Many farmers believe that the charge for mixing is justified by the excellent condition of the fertilizer sent out and the convenience of receiving material ready for application.

The second question is not so easily settled. The most economical combination of plant foods under any given circumstances depends on a number of factors, some of which are out of the farmer's control. The type of crop affects it. A crop of mangolds, for example, removes about 300 lb. of potash from an acre of soil, whereas a normal yield of wheat requires only 29 lb. Leguminous crops are in a class by themselves in that they need no artificial addition of nitrogen, and so forth. The residue of previous manuring must be considered. This depends on the nature of the manuring on the amount of crop removed, and, as far as nitrogen is concerned, on the extent of the drainage through the soil since the manure was applied. Further, there is the unknown factor of the nature of the seasons ahead. For example, in a dry, ripening season plants will usually require less phosphate than in the reverse circumstances. In a showery season suiting vegetative growth less nitrogen will be

required than in a more normal one. Finally, there is the nature of the soil, which usually varies within the limits of the field itself.

The determination of the manurial requirements of soils is as yet carried out by admittedly imperfect methods. Even in Germany where a considerable amount of such work is done only a small fraction of the cultivated land has yet been examined. Accurate field experiments have as yet only sampled a relatively small number of English soils. It appears, therefore, that the specification of a combination of fertilizers to suit any individual case is a complex matter, and few farmers have at present the necessary information available to make an exact determination of the needs of their soil at any particular time.

Although scientific precision is not as yet available, many farmers by accumulated experience and observation have developed a manurial system calculated to suit their special circumstances. They can receive great help in this by calling in the aid of the county advisory authorities. They would probably derive further valuable information if they had the results of well executed field trials carried out on their own soils and directed to solve their own problems. Such a system has been extending on the Continent in recent years.

There still remain, however, a number of users of fertilizers who for some reason are uncertain about the best manurial treatments under their conditions. There is room for a range of mixed fertilizers calculated to meet certain fairly well defined soil and crop requirements. It may be of interest to mention the type of product which is now gaining ground in Germany. Nitrophoska is turned out in the following modifications :—

	N	P ₂ O ₅	K ₂ O
For Cereals (High proportion of Nitrogen) ..	17.5	13.0	22
For Root Crops and Light Soils (High proportion of Potash)	15.0	11.0	26.5
For Soils poor in Phosphate (High proportion of Phosphoric Acid)	16.5	16.5	20.0

Liquid Manure.—Those who have liquid manure tanks in use may find that it is necessary to get rid of some of the accumulated liquid during early winter. Grassland will usually be the best crop to receive the dressing. The risk of losing the manurial value of the liquid by drainage through the soil is small, for soil has a considerable power of retaining ammonia and potash, the two main fertilizing constituents present. The crop-producing effect of liquid manure applied at different

PRICES OF ARTIFICIAL MANURES

Average prices per ton during week
ended November 13.

Description	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	9 14d	9 14d	9 14d	9 14d	12 6
Nitro-chalk (N. 15½%) ..	9 19d	9 19d	9 19d	9 19d	12 10
Sulphate of ammonia :—					
Neutral (N. 20·6%) ..	9 14d	9 14d	9 14d	9 14d	9 5
Calcium cyanamide (N. 20·6%) ..	8 16e	8 16e	8 16e	8 16e	8 7
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%) ..	..	10 10h	..	..	..
Kainit (Pot. 14%) ..	3 5	2 18	2 18	3 1	4 4
Potash salts (Pot. 30%) ..	5 1	4 16	4 18	4 15	3 2
" (Pot. 20%) ..	3 13	3 8	3 6	3 9	3 6
Muriate of potash (Pot. 50%) ..	9 12	8 18	8 17	9 1	3 7
Sulphate, " (Pot. 48%) ..	11 13	11 0	10 19	11 0	4 7
Basic Slag (P.A. 15½%)|| ..	2 13c	2 3c	..	2 9c	3 1
" (P.A. 14%)|| ..	2 7c	1 16c	1 16c	2 3c	3 2
" (P.A. 11%)|| ..	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26·27½%) ..	2 10||	2 7||	..	2 5a	1 8
Superphosphate (S.P.A. 16%)..	3 11	..	3 6	3 6	4 2
" (S.P.A. 13½%)..	3 5	2 16	3 0	3 0	4 4
Bone meal (N. 3½%, P.A. 20½%) ..	8 15	8 10	8 12	8 0	..
Steamed bone flour (N. ½%, P.A. 27½-29½%) ..	5 17b	..	6 10	5 2	..
Burnt Lump Lime ..	1 8k	1 10l	1 11n	2 2m	..
Ground Lime ..	1 12k	..	..	1 17m	..
" Limestone ..	1 3k	..	1 8n	2 6m	..
" Chalk ..	..	1 5	..	1 11m	..
Slaked Lime ..	..	..	2 12n	3 2m	..

Abbreviations: N.—Nitrogen; P.A.—Phosphoric Acid; S.P.A.—Soluble Phosphoric Acid; Pot.—Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‡ Fineness 80% through standard sieve. α. 85% through standard sieve.

§ Delivered (within a limited area) at purchaser's nearest railway station.

¶ Prices for 3-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

|| For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

|| Delivered in 4-ton lots at purchaser's nearest railway station.

A F.o.r. Goole.

B 4-ton lots f.o.r. Bristol: ground limestone 98.95% through standard sieve.

C F.o.r. Knottingley.

m 6-ton lots delivered London district, ground limestone 65% through standard sieve. Ground limestone, ground chalk and slaked lime in non-returnable bags.

n 6-ton lots delivered Liverpool stations, ground limestone 45% through standard sieve. Ground limestone and slaked lime in non-returnable bags.

dates bears out this view. Hendrick found the following hay yields as an average of 10 experiments in Scotland :—

<i>Manure per acre</i>	<i>Hay (cut. per acre)</i>
None	40·3
2,000 gal. Liquid Manure (December)	49·5
" " " (January–February)	51·5
" " " (March)	50·1

The time of application, therefore, makes little difference to the effectiveness.

* * * * * *

NOTES ON FEEDING STUFFS

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The Accuracy of Feeding.—Working out a ration, for any class of stock, which shall approach closely to a certain standard, is quite straightforward, but not extremely easy. Leaving aside all questions such as palatability and the effects of particular foods on the animal, there are two figures which have to be considered primarily—the starch equivalent and the digestible protein. In addition, the final ration must contain a total weight of dry matter sufficient to fill the animal, and within its capacity to consume. To the type of mind which likes solving puzzles the calculation may be interesting, but many people find it very trying : just as two of the figures are correctly adjusted, it is found that the third has gone wrong. In some cases, where the choice of materials is somewhat limited, as, for instance, when there is a large quantity of some food on hand which it is definitely much cheaper to feed than to sell, there is some difficulty in arriving at a satisfactory ration. The question then arises as to how much error is permissible—in other words how accurate should a ration be ?

The writer may as well confess at once that he does not know the answer to this question (in fact he doubts if there is one), but there are a few general considerations that may help to decide whether a ration that has been worked out with the most economic foods is good enough, or whether it is too far from the standards, necessitating the purchase of some other foods to balance it up. In any difficulty it is always helpful to know how other people meet the situation, and at the outset it may be useful to see within a little how accurate farmers are in general. The writer has records of rations fed to dairy herds in East Sussex, each one having been calculated in terms of starch equivalent and digestible protein, and also the standard requirement for those particular cows, giving the yield for

which it was fed. The differences between these two sets of figures at once indicate the errors in feeding, and as the total number of records was over 2,000, errors of weighing, etc., would be largely obliterated, and the figures probably provide a good representative sample of the accuracy of feeding milk-recorded herds. It was found that the following percentages of farmers were within the stated amounts of the scientific requirement:—

		<i>Starch Equivalent</i> lb.	<i>Digestible Protein</i> lb.
50 per cent.	..	1.7 (13)	0.40 (20)
67 per cent.	..	2.5 (19)	0.60 (30)
75 per cent.	..	3.0 (23)	0.70 (35)
90 per cent.	..	4.1 (32)	0.96 (48)
99 per cent.	..	6.5 (50)	1.55 (77)

It should perhaps be mentioned that on the average they were feeding just about right, the mean error being 0.25 lb. too much starch equivalent and 0.14 lb. too much digestible protein, so that the errors given above occurred about equally frequently on each side of the standard. The average yield was between 2 and 2½ gallons, for which the standard would be rather over 13 lb. starch equivalent and 2 lb. digestible protein, and working with these we can calculate the errors as percentages of the standard, these figures being given above in brackets. Some rations were obviously very bad, 10 per cent. of the herds feeding one-third or more too much or too little starch equivalent, and one-half or more too much or too little digestible protein. On the other hand, one-half of the herds were feeding within 13 per cent. of the standard for starch equivalent and 20 per cent. for digestible protein. It was noticed that the size of the errors of feeding did not vary according to the yield of the herd—the men with high-yielding herds were neither better nor worse than the men with low-yielding herds.

The accuracy of any procedure is ultimately limited by the accuracy of the methods employed, and the fundamental basis of working out a ration is a table giving the starch equivalent and digestible protein values per 100 lb. of the various feeding stuffs, so that we must consider how accurate such a table is in its application. To begin with, the figures were obtained from digestibility trials, and however carefully these were carried out they were still liable to be slightly wrong. The greatest danger of error is in the assumption that we must make, that the figures were obtained with feeding stuffs of the same composition as those we wish to feed—that is, that all swedes, for instance, are of the same feeding value per unit of weight: as a matter of fact we know they

are not, but that they vary considerably according to the soil on which they were grown, and also according to the weather while they were growing. (Sugar beet growers will remember the very low sugar content of their produce following the wet summer of 1927, when the average for the whole country was rather over 1 per cent. lower than in 1926 and 1928.) The late Professor Wood carried out experiments with sheep to determine the starch equivalent of swedes, and found that in all cases the figure was approximately 63 per cent. of the dry matter content, but that this latter varied very appreciably. With swedes grown in Norfolk he found that the average dry matter was 9.4 per cent., and with swedes grown in the Fens only 8.1 per cent., whereas Kellner gives a figure of 11.5 per cent. for German swedes. The starch equivalent per 100 lb. of swedes may, therefore, vary anywhere between 5.1 and 7.3, and it is improbable that these are the outside limits: it follows that 50 lb. of swedes in the ration may have a starch value as low as 2.6 lb., or, on the other hand, it may be as high as 3.7 lb. Nor is the value of roots constant all the winter, for respiration continues and the dry matter content falls: in Danish experiments with mangolds and beet it is found necessary to take samples for analysis at frequent intervals, for the dry matter has been found to fall from 12.5 per cent. to 10 per cent. between October and April.

Although the variation with roots is large, it is probably much larger still with hay, in which the composition and nutritive value are affected by the state of maturity at which it was cut, by the varieties of grasses providing it (for there are wide differences between species when they are mature), by the soil, by the manures which are applied, and by the weather during growth and during haymaking. On consulting tables we see that the starch equivalent of meadow hay may be anywhere between 20 and 40, and its digestible protein content between 3.5 and 9. In working out rations due care will naturally be taken in assessing the hay as good, bad, or indifferent, but with such wide variation errors of 10 per cent. or more must be expected—that is, the figures calculated for 20 lb. of hay may easily be wrong by 1 lb. in starch equivalent and $\frac{1}{2}$ lb. in digestible protein. Roots and hay probably vary as much in composition as any foodstuff, but considerable variation must be expected in all. In addition to this no great precision can be attained in weighing out and feeding the rations.

Meticulous accuracy in calculating rations is therefore

illogical, and can only be compared to the practice of working out speeds in motor records to some twenty decimal places, when the timing mechanism can only be relied on to give a result correct to the second decimal place. Feeding standards must be regarded as general guides, and small departures from them need cause no worry, especially when the ration can only be precisely adjusted by the purchase of expensive foods. Errors, of course, do not add, but tend to balance; nevertheless, it is only an optimist who can expect them to neutralize themselves exactly, and with so many approxima-

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	8 2
Maize	81	6.8	8 1
Decorticated ground nut cake	73	41.0	12 0
„ cotton cake	71	34.0	11 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2.04 shillings, and per unit protein equivalent, 2.47 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The “food values” which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	8 11
Oats	60	7.6	7 11
Barley	71	6.2	8 0
Potatoes	18	0.6	1 18
Swedes	7	0.7	0 16
Mangolds	7	0.4	0 15
Beans	66	20.0	9 4
Good meadow hay	37	4.6	4 7
Good oat straw	20	0.9	2 3
Good clover hay	38	7.0	4 15
Vetch and Oat silage	13	1.6	1 10
Barley Straw	23	0.7	2 9
Wheat straw	13	0.1	1 7
Bean straw	23	1.7	2 11

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.		%
Wheat, British..	—	—	9 17	0 11	9 6	72	2 7	1-38	9-6	
Barley, British feeding	—	—	8 5	0 9	7 16	71	2 2	1-16	6-2	
" Canadian feed ..	29 3	400	8 3½	0 9	7 14	71	2 2	1-16	6-2	
" American ..	28 0	"	7 17	0 9	7 8	71	2 1	1-12	6-2	
" Danubian ..	28 6	"	8 0†	0 9	7 11	71	2 2	1-16	6-2	
" Persian ..	30 3	"	8 10	0 9	8 1	71	2 3	1-20	6-2	
" Tunisian ..	28 6	"	8 0½	0 9	7 11	71	2 1	1-12	6-2	
Oats, English, white ..	—	—	8 0	0 10	7 10	60	2 6	1-34	7-6	
" " black and grey ..	—	—	8 13	0 10	8 3	60	2 9	1-47	7-6	
" Canadian No. 1 feed ..	25 9	320	9 0*	0 10	8 10	60	2 10	1-52	7-6	
" Argentine ..	22 3	"	7 15	0 10	7 5	60	2 5	1-29	7-6	
" Chilian ..	23 0	"	8 2	0 10	7 12	60	2 6	1-34	7-6	
" German ..	24 0	"	8 8	0 10	7 18	60	2 8	1-43	7-6	
Maize, Argentine ..	34 6	480	8 2	0 9	7 13	81	1 11	1-03	6-8	
" South African ..	34 3	"	8 0†	0 9	7 11	81	1 10	0-98	6-8	
Beans, English winter ..	—	—	10 0†	1 3	8 17	66	2 8	1-43	20	
" Chinese ..	—	—	10 0½	1 3	8 17	66	2 8	1-43	20	
Peas, English blue ..	—	—	10 2†	1 0	9 2	69	2 8	1-43	18	
" Japanese ..	—	—	18 10½	1 0	17 10	69	5 1	2-72	18	
Millers' offals—										
Bran, British..	—	—	6 10	1 1	5 9	42	2 7	1-38	10	
" broad ..	—	—	7 7	1 1	6 6	42	3 0	1-61	10	
Middlings, fine, imported ..	—	—	7 15	0 16	6 19	69	2 0	1-07	12	
" coarse, British ..	—	—	7 0	0 16	6 4	58	2 2	1-16	11	
Pollards, imported ..	—	—	6 12	1 1	5 11	60	1 10	0-98	11	
Meal, barley ..	—	—	9 10	0 9	9 1	71	2 7	1-38	6-2	
" maize ..	—	—	10 10	0 9	10 1	81	2 6	1-34	6-8	
" " South African ..	—	—	8 15	0 9	8 6	81	2 1	1-12	6-8	
" " germ ..	—	—	9 0	0 14	8 6	85	1 11	1-03	10	
" locust bean ..	—	—	9 5	0 7	8 18	71	2 6	1-34	3-6	
" bean ..	—	—	13 0	1 3	11 17	66	3 7	1-92	20	
" fish ..	—	—	19 0	3 2	15 18	53	6 0	3-21	48	
Maize, cooked flaked ..	—	—	11 0	0 9	10 11	83	2 7	1-38	8-6	
" gluten feed ..	—	—	9 15	0 18	8 17	76	2 4	1-25	19	
Linseed cake, English, 12% oil ..	—	—	14 5	1 7	12 18	74	3 6	1-87	25	
" " " 9% " ..	—	—	13 12	1 7	12 5	74	3 4	1-78	25	
" " " 8% " ..	—	—	13 7	1 7	12 0	74	3 3	1-74	25	
Soya bean " 5½% " ..	—	—	11 10†	1 18	9 12	69	2 9	1-47	36	
Cottonseed cake—										
English, 4½% " ..	—	—	7 7	1 6	6 1	42	2 11	1-66	17	
" " Egyptian, 4½% " ..	—	—	7 2	1 6	5 16	42	2 9	1-47	17	
Decorticated cottonseed meal, 7% oil ..	—	—	12 10*	1 19	10 11	74	2 10	1-52	35	
Coconut cake, 6% oil ..	—	—	10 15	1 3	9 12	79	2 5	1-29	16	
Ground-nut cake, 6-7% oil ..	—	—	10 0†	1 5	8 15	57	3 1	1-65	27	
Decorticated ground-nut cake, 6-7% oil ..	—	—	12 0†	1 19	10 1	73	2 9	1-47	41	
Palm kernel cake, 4½-5½% " ..	—	—	9 15†	0 16	8 19	75	2 5	1-29	17	
" " " meal, 4½% " ..	—	—	10 5†	0 16	9 9	75	2 6	1-34	17	
" " " meal 1-2% oil ..	—	—	9 7†	0 18	8 10	71	2 5	1-29	17	
Feeding treacle ..	—	—	6 7	0 8	5 19	51	2 4	1-25	2-7	
Brewers' grains, dried ale ..	—	—	8 15	0 17	7 18	49	3 3	1-74	13	
" " " porter ..	—	—	8 5	0 17	7 8	49	3 0	1-61	13	
Malt culms " ..	—	—	8 10½	1 5	7 5	43	3 4	1-78	16	

* At Bristol.

† At Hull.

‡ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of October and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22½, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1'43d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 6s. 6d.; P₂O₅, 8s. 6d.; K₂O, 3s. 2d.

tions as must necessarily be introduced in rationing the final result can never be absolutely reliable.

From the above considerations it would appear that in a ration for a cow giving a daily yield of 3 gallons (as an example), which should contain 14 lb. of starch equivalent and 2.5 lb. of digestible protein, an error of $1\frac{1}{2}$ lb. in the former and up to $\frac{1}{2}$ lb. in the latter is not unreasonably large. Even that very careful worker Kellner has stated that an error of 10 per cent. or rather more is permissible. The conclusion that the reader may come to is that the accuracy to be aimed at is that achieved by one-half of the East Sussex milk recording farmers, who feed within 1.7 lb. of starch equivalent and 0.4 lb. of digestible protein—if so many others can do it this degree of precision should be attainable. It can, of course, be improved on if the choice of foods is not restricted: as the protein is the most expensive part of the ration special care may be taken to keep that constituent close to the standard.

Nothing has been said about the total dry matter contained in the ration, but the same considerations will apply: indeed, it is probable that a greater deviation from the standard might be tolerated in this case, for individual animals will have their own peculiarities in this respect. One point aimed at in producing a really good cow is a large barrel, and this is desired because it is believed that it means larger viscera, and consequently the capability of dealing with larger quantities of food. This assumes that there are considerable differences between the capacities of animals similar in other respects. Of course, we must always have some guide as to the appetite of animals, but to suggest that this can be rigidly applied to all cases is as unwarranted as to assert that all people eat a standard-sized dinner.

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MISCELLANEOUS NOTES

THE first Conference of National Mark Egg Packers was held in London on October 24 and 25, 1929. The Rt. Hon.

**National Mark Egg
Scheme : Conference
of Authorized
Packers**

Noel Buxton, M.P., Minister of Agriculture and Fisheries, opened the proceedings and referred to the remarkable progress which had been made in the matter of egg marketing during the past year. He pointed out that this time last

year there were no such things as statutory standards of weight and quality for home-produced eggs. Such standards had to-day already become widely recognized in the trade and by the public, and it was unthinkable that we should ever go back to the haphazard state of affairs when true values were difficult, if not impossible, to assess, and eggs were just eggs, whether good, bad or indifferent—large, small or medium. Great advances had also been made in the technique of candling, grading and packing. It was a striking fact that before the scheme came into operation quite a number of packers never candled an egg, and probably did not know how to. Skilled candlers were therefore rare, and the Ministry had to improvise training facilities. Now, through the National Mark packing stations, a corps of highly skilled candlers was being built up. This was human equipment of the most valuable and necessary kind from the standpoint of the home egg industry.

Referring to improvements in grading and packing, Mr. Buxton said that a year ago scarcely one of the machines, which were now on exhibition in the Conference building, was on the market ; a year ago the fiberite case, which was now quite a feature of the trade, was also practically unknown as a non-returnable package for eggs.

Mr. Buxton complimented the National Mark packing stations on the yeoman service which they had rendered to egg producers and to the country generally in this march forward. They had borne the brunt of introducing a new article—the National Mark egg—to the trade and public, and, although there had been difficulties to face, on the whole there was no doubt that remarkable progress had been made. There were still, however, difficult problems to tackle, and Mr. Buxton drew special attention to the most important item before the Conference, *viz.* the question of forming some kind of co-operative federation of egg-packing stations. Just as the packing station represented a change from individual to

collective marketing, so, Mr. Buxton said, we must contemplate the packing stations getting together to evolve, in time, a still higher form of commercial organization in which the station loses something of its individuality in exchange for the advantages which are to be obtained from central selling, combined action for storage, advertising, and so forth. Like every other form of industrial activity, the business of egg-marketing must respond to the urge for rationalization.

Following Mr. Buxton's address, the Conference proceeded to discuss a number of questions of great importance to the future development of the National Mark Egg Scheme.

The Conference recommended that the National Mark should not, for the present, be applied to individual eggs, but, in continuance of the existing practice, should be applied to containers only. There was, however, a strong feeling that there should be some means of identifying ungraded supplies of home-produced eggs not sold under the Mark. A prolonged discussion ensued on the subject of the compulsory sale of eggs by weight or by statutory grade, and finally issued in a resolution, passed without dissent, to the effect that it should be made compulsory for all British eggs bought for re-sale to be bought by weight or statutory grade. Careful consideration was given to the present statutory grades, and it was felt that while the minimum egg weights were generally acceptable and should be maintained, the National Mark should be applicable to packages of all first quality fresh eggs of marketable size. It was, accordingly, recommended that a fourth grade should be provided to accommodate eggs weighing from $1\frac{1}{2}$ to $1\frac{3}{4}$ oz. In regard to nomenclature, it was regarded as desirable to emphasize the fact that eggs of the statutory grades were all of first quality, the difference between the grades being one of weight only. It was, therefore, recommended that the grade designation should, in future, be "Special Weight," "Standard Weight," "Medium Weight," "Pullet Weight."

The Conference was of opinion that the present requirement as regards the use of new non-returnables should be adhered to, but that a standard type of returnable case, of approved design, should be allowed without restriction. There was general agreement that the dating of containers of National Mark eggs should be enforced, the date of packing to be code-marked on the outside of the case and recorded on a slip inside the case. In addition to the foregoing, a general discussion ensued on candling technique, the minimum pro-

portion of output to be marked under the National Mark, publicity, and the Ministry's inspection service.

The proceedings on the second day were devoted solely to consideration of the suggested formation of a Federation of Authorized Packers. This subject, especially in its relation to the establishment of selling agencies in consuming centres, was fully explored, and a resolution was passed unanimously approving in principle the formation of a Federation, and inviting the Ministry to appoint a committee, representative of the packers, to work out the details of a scheme of federation for consideration by the packers and other interests concerned.

The passing of this resolution was followed by a general discussion of other questions with which a Federation might be expected to deal, *viz.*, contract conditions, overlapping of packing stations, methods of dealing with surplus, disposal of second quality and cracked eggs, also of eggs showing blood spots, etc., collection of marketing intelligence and advertising. With regard to the collection of market intelligence, the Conference expressed a desire that, pending the formation of the Federation, the Ministry should undertake, with the co-operation of authorized packers, to arrange for the publication of reliable information concerning current selling prices of National Mark supplies.

The Conference, at which representatives of over 100 packing stations were present, has undoubtedly served a useful purpose. The recommendations of the Conference will be considered by the Ministry and the views of representative organizations of producers and distributors will be sought as necessary.

A number of egg-grading machines and other appliances of the latest type were exhibited and demonstrated by the makers.

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THE sixth Annual Conference of County and College Dairy Instructors and Instructresses in England and Wales, convened by the Ministry, was held on October 24 at Montagu House, Whitehall, under the Chairmanship of Mr. J. F. Blackshaw, O.B.E., the Ministry's Dairy Commissioner. In addition to County and College Instructors and Instructresses, there were present a number of Agricultural Organizers and Principals of Agricultural Colleges, the total attendance being 130. The

Conference was opened by the Minister, who was supported by the Permanent Secretary of the Ministry.

Papers on the following subjects had been circulated before the date of the meeting :—

"Clean Milk Production and the Trade," by Mr. J. Holmes, B.Sc., N.D.D., Ministry's Dairy Inspector.

"Accredited Milk Producers," by Mr. W. T. Price, M.C., N.D.A., N.D.D., Agricultural Organizer for Wiltshire.

"The Testing of Agricultural (including Dairy) Machinery," by Mr. P. Barker, Secretary of the Ministry's Agricultural Machinery Testing Committee.

"Milk Consumption in Schools," by Mr. A. D. Allen, O.B.E., Organizer, National Milk Publicity Council.

"The Preservation of 'Starter,'" by Mr. A. Todd, British Dairy Institute, Reading.

"Fuel Consumption on Dairy Farms," by Mr. T. W. McDougall-Porter, M.C., N.D.A., Principal of Borden Farm Institute, Kent.

"Dairy Students' Association," by Miss A. Colnett, N.D.D., Instructress in Dairying, Gloucestershire.

"A Suggestion for Revision Courses for Dairy Instructors," by Miss D. V. Dearden, N.D.D., National Institute for Research in Dairying, Reading.

Each paper was introduced at the meeting with a short address, and was followed by open discussion.

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THE Eighth Annual Conference of County and College Poultry Instructors was held on October 22 at the offices of the Board of Education, the Ministry's Poultry Commissioner, Mr. P. A. Francis, O.B.E., occupying the chair. **Ninety Poultry Instructors' Conference, 1929** Instructors, Agricultural Organizers, Principals of Colleges, and others were

present. The proceedings were opened by the Permanent Secretary of the Ministry, Sir Charles Howell Thomas, K.C.B., who referred to the remarkable decline in egg imports during the year, which he attributed to the National Mark Scheme. He expressed the hope that the forthcoming World's Poultry Congress would result in a great increase of public interest in the home industry.

Mr. N. S. Barron contributed a paper entitled "Questions Relating to Diseases of Poultry," after which Captain T. N. Doyle demonstrated a new vaccine immunizing poultry against avian diphtheria. An account of a scheme for the "Co-operative Preparation and Marketing of Table Poultry" in Gloucestershire was given by Mr. E. A. King; Mr. Bruce Wilcock spoke on "Slatted Ark Types of Housing," with special reference to the Worcestershire Ark; while "Simpler Feeding for Egg Production" formed the subject of a paper by Miss D.

Thompson. The Chairman and Mr. J. A. McGilvray described the progress made in the arrangements for the World's Poultry Congress, 1930. In the afternoon, Mr. E. T. Halnan dealt with the "Mineral Feeding of Poultry"; Major H. D. Day spoke on "The Value of the Blood Agglutination Test for Bacillary White Diarrhœa"; and Mr. C. E. Fermor on "Rearing Methods for the Production of Table Poultry." Mr. C. D. Ross described the Approved Cockerel Distribution Scheme now being operated in Devon. All the addresses were followed by open discussion.

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THE following table, which has been prepared from a statement issued by the Department of Agriculture for Scotland, shows the acreages in Scotland, 1929 of potatoes grown in Scotland in 1929, with corresponding acreages in 1928.

			1929	1928
			Acres	Acres
Total acreage grown	..	..	145,000	144,026
Total first earlies	..	..	15,144	15,059
Total second earlies..	..	..	20,550	19,413
Total maincrops	..	..	91,278	92,423
Total unclassified	..	..	18,028	17,131

Acreage figures for the more important varieties only are as under :—

First Earlies—

Epicure	..	..	7,939	8,128
Duke of York, etc.	..	..	2,408	1,850
Sharpe's Express	..	..	1,954	1,341
Eclipse, etc.	..	..	1,794	2,878
May Queen	..	..	317	234
Ninetyfold	..	..	189	153
Herald	..	..	132	38

Second Earlies—

Great Scot	..	..	13,777	12,287
British Queen, etc.	..	..	3,530	3,568
Ally	..	..	962	1,542
Royal Kidney, etc.	..	..	697	445

Maincrops—

Immune—

Kerr's Pink	..	..	47,329	44,539
Majestic	..	..	7,537	8,024
Golden Wonder, etc.	..	..	6,716	7,429
Arran Consul	..	..	1,610	2,430

Non-Immune—

King Edward	15,324	13,310
Arran Chief	5,812	8,343
Up-to-date	1,657	1,544
Field Marshal	479	912

A decrease of 1,145 in the acreage of main crops is accounted for mainly by a decrease of 1,063 acres in the non-immune varieties. This decrease has taken place despite an additional area under King Edwards of 2,014 acres above 1928. The acreage under Arran Chief has diminished by 2,531 acres or over 30 per cent. of the area planted last year, while the Field Marshal variety has undergone a decrease of 433 acres, or nearly 50 per cent. of last year.

Among the chief immune maincrop varieties it will be observed that Kerr's Pink alone has increased in acreage.

The Scottish estimates of yield for this year are not yet available, but for comparative purposes it may be stated that the preliminary estimates already issued for England and Wales indicate a yield of 6.2 tons per acre in 1929 as against 7.2 tons in 1928.

* * * * *

PRICES of agricultural produce in October averaged 42 per cent. above the level of the base years, 1911-13, as compared with 52 per cent. in August

The Agricultural Index Number and September and 39 per cent. in October last year. The drop of 10 points on the month was due mainly to the lower

index figure recorded for milk; fat cattle and cereals were rather cheaper, but the resulting decreases in the case of the two latter were partially offset by increases in eggs and pork pigs.

Percentage increase compared with the
average of the corresponding month in
1911-13

Month	1924	1925	1926	1927	1928	1929
January	60	71	58	49	45	45
February	61	69	53	45	43	44
March	57	66	49	43	45	43
April	53	59	52	43	51	46
May	57	57	50	42	54	44
June	56	53	48	41	53	40
July	53	49	48	42	45	41
August	57	54	49	42	44	52
September	61	55	55	43	44	52
October	66	53	48	40	39	42
November	66	54	48	37	41	—
December	65	54	46	38	40	—

Grain.—Quotations for wheat were reduced by about 5d. per cwt., and the index figure was four points lower at 27

per cent. in excess of pre-war. Values for barley and oats fell by 4d. and 2d. respectively per cwt., and the index numbers declined by six and five points to 21 and 12 per cent. over the base level. As compared with October, 1928, all three kinds of grain were cheaper, wheat by 1d. per cwt., barley by 6d., and oats by 1s.

Live Stock.—Fat cattle again realized lower prices, and the index figure showed a further fall of three points to 31 per cent. over 1911-13. Fat sheep were little altered, but porkers became about 8d. per stone dearer at 64 per cent. above pre-war. Bacon pigs, however, were slightly cheaper, and the index figure fell by two points to 50 per cent. in excess of the level of the base years. With a full demand continuing, prices of store cattle were reduced by about 7s. per head and the index figure by five points. Values for dairy cows rose by about 5s. per head, but as this increase was proportionately less than in the corresponding period of the base years, the index figure showed a slight fall. Quotations for store sheep and store pigs were rather higher, but while the index number for pigs rose by 12 points to 95 per cent. over pre-war, that for sheep was ten points lower on account of the relatively greater increase occurring between September and October of the base years.

Dairy and Poultry Produce.—Prices of milk showed little change in most districts, but the index number fell by 52 points to 55 per cent. above 1911-13. Owing to the fact that during August and September in the base years milk prices were on a summer basis whereas during the current year a winter scale of prices obtained for those months, the index figures for milk in August and September, 1929, were unusually high, and the restoration of a normal basis of comparison, i.e., between two winter months, caused the October index to assume more normal proportions. Butter was a little dearer at 55 per cent. above pre-war, but cheese was unchanged in price. Values for eggs advanced sharply, and the index number was 24 points higher at 81 per cent. in excess of the base period. Poultry again averaged 45 per cent. over 1911-13.

Other Commodities.—Potatoes became rather dearer, and the index number rose by five points to 17 per cent. above pre-war. Hay also advanced further in price, but as a proportionately more pronounced increase took place in the base years, the index figure fell by two points. Prices of apples averaged about 30 per cent. over pre-war, but pears were a little cheaper than in October, 1911-13. The index number

for vegetables appreciated by 28 points to 54 per cent. in excess of the level of the base period.

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1927	1928	1929			
	Oct.	Oct.	July	Aug.	Sept.	Oct.
Wheat	42	28	28	40	31	27
Barley	62	26	30	31	27	21
Oats	33	27	23	30	17	12
Fat cattle	23	31	30	36	34	31
Fat sheep	41	52	55	59	55	55
Bacon pigs	22	26	64	60	52	50
Pork pigs	35	33	61	60	55	64
Dairy cows	27	39	33	35	35	34
Store cattle	19	20	25	19	16	11
Store sheep	40	54	60	64	63	53
Store pigs	56	31	80	85	83	95
Eggs	66	66	57	59	57	81
Poultry	43	51	57	47	45	45
Milk	57	57	57	93	107	55
Butter	41	55	52	48	52	55
Cheese	56	78	67	62	42	37
Potatoes	72	51	—4*	2	12	17
Hay	18	6	29	41	42	40
Wool	43	70	45	47	47	42

* Decrease.

* * * * *

THE Annual Cow Judging Competition for teams drawn from Young Farmers' Clubs in this country was held at the Dairy Show, by the courtesy of the Young Farmers' British Dairy Farmers' Association, on Clubs : Annual October 24, 1929. Six teams competed for the Silver Challenge Cup awarded by the Dairy Cow Judging Contest, the *Farmer and Stock-Breeder and Agricultural Gazette*, and Silver and 1929 Bronze Medals presented by the British

Dairy Farmers' Association. Three rings of four dairy cows each, of the British Friesian, Shorthorn and Jersey breeds were judged, maxima of 50 points being awarded for correct placing and 50 points for reasons for placing.

Horsham Calf Club succeeded in obtaining first place with 652 points (maximum 900), 24 points ahead of Cuckfield Jersey Calf Club. Three points only separated the teams placed fourth, fifth and sixth, the totals being :—

(1) Horsham Calf Club	652 points
(2) Cuckfield Jersey Calf Club	618 ..
(3) Buckingham Royal Latin School Calf Club	610 ..
(4) Kingsclere Calf Club	598 ..
(5) Buckinghamshire Calf Clubs (B Team)	596 ..
(6) Northumberland Calf Clubs	595 ..

In the individual scoring two competitors tied for first place with 243 points (maximum 300). The first seven places were obtained by :—

Tied	{ (1) Elsie Tidey (Cuckfield Jersey Calf Club) Jack Hitchings (Kingsclere Calf Club) }	243 points
	(3) Maurice Robert Anstee (Hor- sham Calf Club)	240 ..
	(4) Arthur William Culley (Buck- ingham Royal Latin School Calf Club)	229 ..
	(5) Dora Dowding (Horsham Calf Club)	220 ..
Tied	{ (6) Lilian Josephine Armstrong (Northumberland Calf Clubs) Peggy Busby (Buckingham Calf Clubs (B Team)) }	210 ..

This was the first appearance at these contests of the competitors who secured the three highest places.

At the close of the contest Mr. Gilbert on behalf of the judges congratulated the competing teams on their performance, and explained why the cows had been placed as they had been by himself and his colleagues. Mr. R. C. Norman presented the Cup to the winning team.

* * * * *

The Imperial Fruit Show, 1929.—The ninth Imperial Fruit Show held this year at the Bingley Hall, Birmingham, from October 25 to November 2, proved to be the most successful of the series and probably the most successful show of any kind held in the Bingley Hall. To those in close touch it was quite evident that the show is the biggest effort to popularize Empire fruits

that has been made in this country. The attendance for the eight days approximated 90,000 and every night the show was packed to capacity. Growers attended from all parts of the country in greater numbers than ever before.

In the British Empire section, which included two classes of 50 boxes for English growers, no less than 149 entries were staged: comprizing 16 tons of apples free from blemish and uniform in size. It is notable that practically the whole of the prize winners are registered packers under the National Mark scheme.

A feature of the Ministry of Agriculture's marketing demonstration illustrated opposite was the "Ideal" grader, with the aid of which demonstrations were given many times daily in the grading, sizing and packing of apples and pears.

Other Demonstrations.—Marketing demonstrations covering pigs and pig products have been given during the past month at the Doncaster Potato Show and at the Stoke-on-Trent Fatstock Show.

The standard grades which have recently been promulgated for potatoes were demonstrated at the Spalding Potato Show and the Doncaster Potato Show.

It is proposed to stage the pig-marketing demonstration at the Smithfield Club Show at the Agricultural Hall, London, on December 9 to 13.

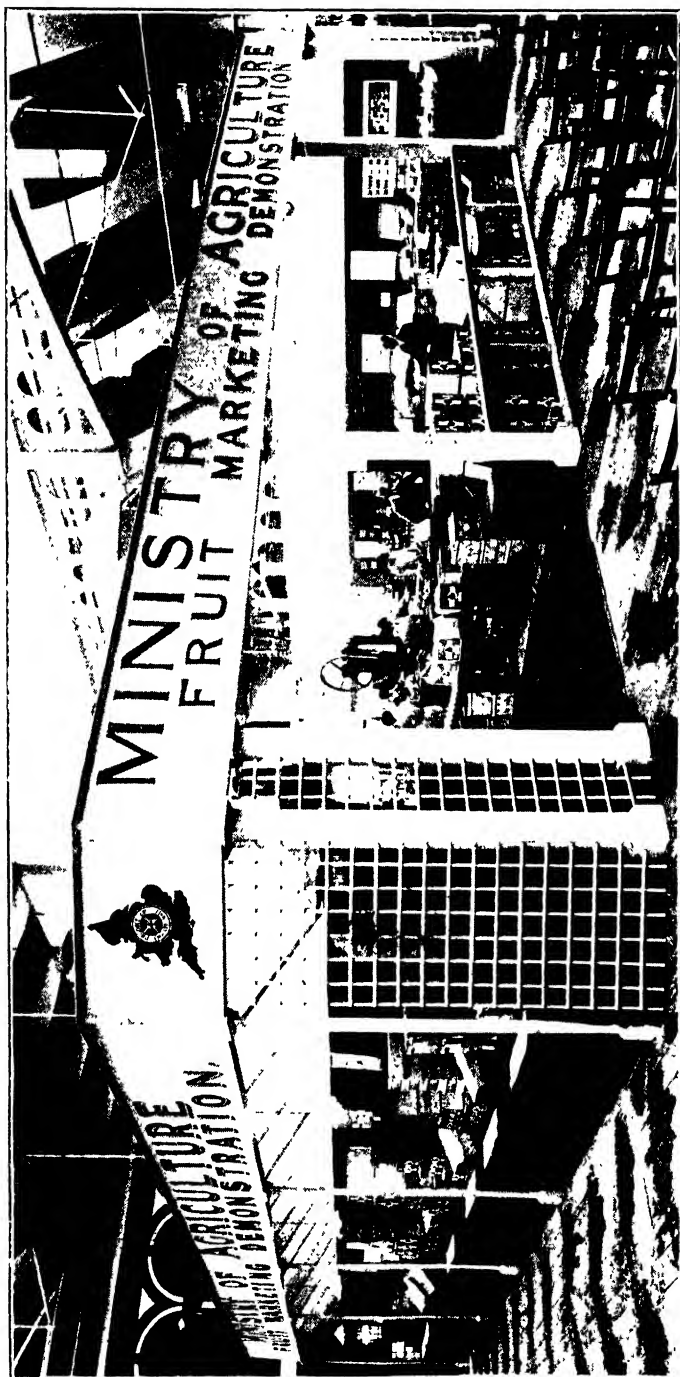
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Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on Tuesday, October 22, and Wednesday, November 6, 1929, at 7 Whitehall Place, London, S.W. 1.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying these decisions into effect :—

Cambridgeshire and Isle of Ely.—An Order continuing from November 1, 1929, until October 31, 1930, the minimum and overtime rates of wages for male and female workers at present in force in the area. The minimum rate in the case of male workers of 21 years of age and over employed wholly or mainly as horsemen, cowmen, or shepherds is 37s. per week of the hours necessary for the performance of the customary duties of workers so employed. In the case of other male workers of 21 years of age and over, the minimum rate is 30s. per week of 40 hours in the week in which Christmas Day falls, 48 in any other week in winter, 42 in the week in which Good Friday falls, and 50 in any other week in summer, with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays, Christmas Day and Good Friday. In the case of female workers of 18 years of age and over, the minimum rate is 5½d. per hour, with overtime at 7d. per hour.

Cheshire.—An Order continuing the operation of the existing minimum and overtime rates of wages for male workers and the minimum rates of wages for female workers from November 1,



The Ministry's Fruit Marketing Demonstration Stand at the Imperial Fruit Show, Birmingham, 1929.

1929, to October 31, 1930. The minimum rate in the case of male workers of 21 years of age and over is 35s. per week of 54 hours, with overtime at 9d. per hour, and in the case of female workers of 18 years of age and over 6d. per hour for all time worked, provided that in the case of such workers engaged for milking the wage shall be not less than 6d. per "meal," i.e., each occasion on which the worker visits her place of employment for the purpose of milking.

Oxfordshire.—An Order cancelling as from October 27, 1929, the existing minimum and overtime rates of wages for male and female workers, and fixing rates in substitution therefor from October 28, 1929, until October 25, 1930. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 39½ hours in the week in which Christmas Day falls, 48 hours in any other week in winter, 41 hours in the weeks in which Easter Monday and Whit Monday fall and 50 hours in any other week in summer, with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays, Christmas Day, Easter Monday and Whit Monday. In the case of female workers of 18 years of age and over, the minimum rate is 6d. per hour with overtime at 7½d. per hour on weekdays and 9d. per hour on Sundays, Christmas Day, Easter Monday and Whit Monday.

Warwickshire.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and female workers from October 28, 1929, until October 27, 1930. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 50 hours in summer and 48 hours in winter, with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over, the minimum rate is 5d. per hour, with overtime at 6d. per hour on weekdays and 7½d. per hour on Sundays.

Wiltshire.—An Order cancelling as from November 10 the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers and fixing fresh rates to operate as from November 11, 1929 until December 20, 1930. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 39½ hours in the week in which Christmas Day falls, 48 hours in any other week in winter, 41 hours during the week in which Good Friday falls, and 50 hours in any other week in summer; with overtime at 8d. per hour except for overtime employment on harvest work in the hay and corn harvests when the rate is 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for all time worked.

East Riding of Yorkshire.—(1) An Order to come into operation on November 24, 1929 (the day following that on which the existing rates are due to expire) and to continue in force until November 23, 1930, fixing minimum and overtime rates of wages for male and female workers. The rates in the case of male workers engaged by the year and boarded and lodged by their employer are: foremen, £81 12s. 0d.; beastmen and shepherds, £73 19s. 0d.; waggoners, £71 8s. 0d., with lesser rates for lads and beginners. These rates are payable in respect of a year consisting of 51 weeks of the following number of hours—in the week in which Good Friday falls, 43, in any other week in summer, 52½; in the week in which Christmas Day falls, 39½, and in any other week in winter 48 with, in addition, in each case not more than 12 hours per week on weekdays and 3 hours on Sunday spent on work

in connexion with the care of and attention to stock. In the case of other male workers boarded and lodged by their employer the minimum rates are: foremen, 32s.; beastmen and shepherds, 29s.; waggoners, 28s. per week, with lesser rates for lads and beginners, these rates being payable in respect of the same number of hours per week as in the case of workers engaged by the year. The minimum rate for male workers of 21 years of age and over who are not boarded and lodged by their employer is 36s. (instead of 35s. as at present) per week of 48 hours in winter and 52½ hours in summer except that in the week in which Christmas Day falls the hours for which the minimum wage is payable are 39½ and that in the week in which Good Friday falls the hours are 43. The overtime rates for all classes of male workers of 21 years of age and over are 10d. per hour on weekdays and 1s. per hour on Sundays, Good Friday and Christmas Day. In the case of female workers of 16 years of age and over the minimum rate is 6d. per hour, with overtime at 9d. per hour.

(2) An Order fixing special differential rates of wages for overtime employment on the corn harvest in 1930, the rates in the case of male workers boarded and lodged by their employer being 1s. per hour for foremen, beastmen, shepherds and waggoners, with lesser rates for lads. In the case of other male workers of 21 years of age and over the rate is 1s. 3d. per hour and for female workers of 16 years of age and over 11d. per hour.

Yorkshire (West Riding).—An Order continuing (with minor amendments) the operation of the existing minimum and overtime rates of wages for male and female workers from October 24, 1929, until November 23, 1930. The minimum rates in the case of male workers who are boarded and lodged by their employer are: foremen, 33s. per week or £85 16s. 0d. per annum; beastmen and shepherds, 32s. per week or £83 4s. 0d. per annum; waggoners, 30s. per week or £78 0s. 0d. per annum, with lesser rates for lads, these rates being payable in each case in respect of a week of 48 hours in winter and 52½ hours in summer with, in addition, not more than 12 hours per week on weekdays and 3 hours on Sundays for work in connexion with the care of and attention to stock. In the case of waggoners and other horsemen, beastmen and shepherds of 21 years of age and over who are not boarded and lodged by their employer, the minimum rate is 42s. per week for the same number of hours as in the case of workers living in. The minimum rate for other classes of male workers of 21 years of age and over is 36s. per week of 48 hours in winter and 52½ hours in summer. The overtime rates of wages for all classes of male workers of 18 years of age and over are 11d. per hour on weekdays and 1s. 1d. per hour on Sundays. In the case of female workers of 18 years of age and over, the minimum rate is 6d. per hour, with overtime at 7½d. per hour.

Cardiganshire.—An Order to come into operation on November 15, 1929 (the day following that on which the existing rates are due, to expire) and to continue in force until November 14, 1930, fixing minimum and overtime rates of wages for male and female workers. The minimum rate in the case of male workers of 21 years of age and over is 31s. for a seven-day week of 54 hours, with overtime at 8½d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour, with overtime at 6d. per hour.

Radnor and Brecon.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and

female workers from November 1, 1929, until April 30, 1930. The minimum rate in the case of male workers of 21 years of age and over is 3ls. per week of 54 hours in summer and 48 hours in winter, with overtime at 9d. per hour. In the case of female workers of 18 years of age and over, the minimum rate is 5d. per hour, with overtime rates at 6½d. per hour on weekdays and 7½d. per hour on Sundays.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending November 15, legal proceedings were instituted against 18 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages	No. of workers in- volved
		£	s.	d.	£	s.	d.		
Cumberland ..	Cockermouth	2	0	0	1	0	8	15 13 0	2
"	"	2	0	0	1	0	8	19 6 0	2
"	"	2	0	0	1	0	8	25 0 0	3
Derby ..	Chesterfield ..	3	0	0	0	8	0	40 0 0	2
Hereford ..	Ross-on-Wye	—			0	19	0	2 10 0	2
Lancaster ..	Garstang ..	—			0	4	0	5 0 9	1
"	St. Helens ..	4	0	0	0	2	0	39 0 0	2
Salop ..	Wem ..	4	0	0	—			14 6 9	2
Somerset ..	Shepton Mallet	2	0	0	0	10	0	11 16 0	2
"	Temple Cloud	10	0	0	—			51 15 6	2
"	Wincanton ..	6	0	0	2	2	3	25 10 1	5
"	Yeovil ..	—			0	5	0	13 0 0	1
Wilts ..	Warminster ..	0	5	0	—			1 0 4	3
Yorks, N.R. ..	Malton ..	3	18	0	0	6	0	119 17 6	6
Anglesey ..	Amlwch ..	0	10	0	—			32 0 0	1
Caernarvon ..	Pwllheli ..	1	0	0	—			3 15 0	1
Carmarthen ..	Newcastle ..	—			Case dismissed			—	1
		Emlyn							
Denbigh ..	Llangollen ..	*			0	11	0	3 9 4	1
		£40 13 0			£8 9 3			£423 0 3	39

* Dismissed under Probation of Offenders Act.

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Perquisites in Lieu of Cash Wages : High Court Decision.—On November 7, a Divisional Court, consisting of the Lord Chief Justice, Mr. Justice Avory, and Mr. Justice Swift, heard the Ministry's appeal against the decision of the Tregaron (Cardiganshire) Magistrates in a case which was brought before them on May 28, 1929.

The Magistrates decided that although legally there were arrears of wages due to the worker, the value of washing and mending which was provided was sufficient to counterbalance the amount of arrears and they dismissed the case. Washing and mending is not defined by the Pembroke and Cardigan Agricultural Wages Committee as a benefit or advantage which may be reckoned as payment of wages in lieu of payment in cash. The Ministry considered that in taking

the value of washing and mending into account the Magistrates were wrong in law, and accordingly the case was taken to the High Court for a decision. The Divisional Court held that this point had already been decided in the case of *HAYES v. CURTIS*, and upheld the appeal.

The Magistrates stated in the alternative that if the respondents were not entitled to reckon the value of the washing and mending as part payment of wages the offence was trivial and they would have dismissed the case. The Divisional Court held that the Magistrates could not properly find that the offence was trivial and that there must be a conviction. The following is a transcript of the shorthand notes of the Judgment.

The Lord Chief Justice : This is a Case stated by Justices for the County of Cardigan. An information was preferred by the present Appellant against the Respondents for that being persons who employed a certain worker in agriculture they did not pay wages to him at a rate not less than the minimum rate as fixed under the provisions of the Agricultural Wages (Regulation) Act, 1924, and the Orders of the Agricultural Wages Board and of the Agricultural Wages Committee made in that behalf. The Justices having heard the Information dismissed it, and the question for us is whether they came to a correct conclusion in point of law.

As to the facts there appears substantially to have been no dispute. In November, 1926, the Respondents had entered into an oral contract with Geater the agricultural labourer whereby they agreed to employ him as a worker in agriculture on certain farms of theirs in the County of Cardigan. He was hired on a yearly hiring from November 15 to November 12 at wages of £38 a year together with his board and lodging, but there was a further agreement that the Respondents should do washing and mending for Geater for a sum of 2s. a week. Similar terms were agreed in the subsequent year and in fact during the whole period the Respondents paid to the man a yearly wage of £38 in cash, they provided board and lodging for him and they did washing and mending for him, and throughout the period the weekly value of that work of washing and mending was reckoned in part payment of wages. The Justices further found as a fact that if the value of the washing and mending cannot be reckoned in part payment of wages then the arrears of wages due to Geater were £5 1s. 0d.

The contest in the Court below evidently was upon one question and one question only, namely, whether the Respondents were entitled to set off against the claim for wages, or, to put it in another way, to reckon as part payment of wages the value of the washing and mending which had been done under this agreement, about 2s. a week.

The law upon the matter is perfectly clear, it is entirely free from any sort of ambiguity, and no doubt for persons affected by the legislation it is extremely important. Under the Agricultural Wages (Regulation) Act, 1924, it is provided by section 7, sub-section 1, that : "Where any minimum rate of wages has been made effective by an order of the Agricultural Wages Board under this Act, any person who employs a worker in agriculture shall, in cases to which the minimum rate is applicable, pay wages to the worker at a rate not less than the minimum rate, and, if he fails to do so, shall be liable on summary conviction in respect of each offence to a fine not exceeding £20 and to a fine not exceeding £1 for each day on which the offence is continued after conviction." By sub-section 3 of the same section it is provided that : "In any proceedings against an employer under this section the Court shall"—the words are imperative, "the Court shall"—"whether there is a conviction or not, order the employer to pay in addition to the fine, if any, such sum as may be found by the

Court to represent the difference between" the amount that was paid and the amount that ought to have been paid. Now all the requisite steps were taken in this part of the country under this Statute, and in particular steps were taken in accordance with the provisions contained in section 8. Under that section the Minister has power to make regulations, among other things, for requiring the Wages Committee by Order to define the benefits or advantages not being benefits or advantages prohibited by law which may be reckoned as payment of wages in lieu of payment in cash and the value at which they are to be taken. Those regulations were made, and those regulations were acted upon, and at the material date the Committee in this part of the country, the Pembroke and Cardigan Agricultural Wages Committee, had set out in a perfectly clear Order a definition of the benefits or advantages which might be reckoned as payment of wages in lieu of payment in cash. It is enough to say with regard to that Order that washing and mending are not included. In other words, what has taken place here was that, notwithstanding the definition made by the Committee of the benefits and advantages which might be treated as part payment, these Respondents had chosen to treat as part payment something which was not included in the definition. Now that, it seems to me, whatever the amount of money it involved may be, is a serious matter. If that kind of conduct were to be at all general it would strike at the very root of the legislation, it would be perfectly idle to prescribe elaborately and by a jointly representative body what advantages and benefits may be taken into account if the definition is to be disregarded and individuals in the exercise of their discretion are to enlarge or to ignore the definition. Here the Justices came to the conclusion primarily that no offence had been committed at all. They came to the conclusion that the Respondents were entitled to reckon 2s. a week in respect of washing and mending as part payment of the minimum wages fixed by the said Order, and that no offence had been committed. It is difficult to imagine how that conclusion could possibly have been arrived at because it is a mere matter of reading plain words to see that washing and mending are not included in the definition of the benefits and advantages which may be so regarded, and, indeed, to-day the learned Counsel who has urged everything that can be urged on behalf of these Respondents has not ventured to attempt to support that fundamental finding. It would have been an impossible task. Cases of the kind have been before this Court before, and to cite one example in *HAYES v. CURTIS* in 44 *Law Times Reports*, 619 at page 621, in giving judgment I find I said: "In other words, the price of the milk was treated as part of the wages. The Justices found with some hesitation that this deduction was allowable, that it was 'in the nature of a sale,' and that the cowman 'in effect' paid for the milk. It is clear that the Respondent has done the very thing which the Statute and Orders provide that he is not to do! Those remarks are equally applicable to the present case. But the case does not end there, and as throwing light upon what did take place in the Court below I cannot fail to observe that not only have the Justices found that no offence was committed, they have not even made the Order under section 7, sub-section 3, that the arrears which they find to be due shall be paid. The words of section 7, sub-section 3, one would have thought are perfectly plain: "The Court shall, whether there is a conviction or not, order the employer to pay in addition to the fine, if any, such sum as may be found by the Court to represent the difference," etc. These Justices found as a fact that if the washing and mending were not to be included the arrears of wages were £5 1s. 0d.

They add in the Case stated an alternative, and with regard to that alternative it is interesting to learn that in the Court below the Probation of Offenders Act, 1907, was not so much as mentioned. One wonders when and how this alternative came into this Case. This Court has said again and again that it is not a correct use of the Probation of Offenders Act to have recourse by way of after-thought to its provisions or any of them in order to provide a second line of defence. The Justices here have found in the alternative that if the Respondents were not entitled to reckon the said sums of 2s. per week as part payment, the offence was trivial, and so trivial, apparently, that, as I have pointed out, no Order was made even in the alternative for the payment of the arrears. I cannot see any ground upon which these Justices in these circumstances were entitled to say that the offence, if committed, was trivial. The amount indeed may not be a large amount of money considered in itself, though perhaps it is not so negligible an amount of money considered from the point of view of a worker on a farm. The question is not as to the quantum of money, the question is as to the nature of that which has been done or omitted, and the essential characteristic of what has been done here is that it is conduct entirely subversive of the elaborate provisions of this Statute. I do not think the Justices could properly find this offence was trivial. I think, therefore, this appeal ought to be allowed and the Case ought to go back to the Justices with a direction to convict and to make an Order for the payment of the arrears.

Mr. Justice Ivory : I am of the same opinion. It is significant that this Case states the attention of the Justices was called to the reported case of *HAYES v. CURTIS* in 44 *Times Law Reports* at page 619. That is a decision directly in point on the question which was before the Justices, and their attention having been called to it they apparently refused to be bound by it and said : " Notwithstanding that decision we will hold that there was no offence committed in this case." Under these circumstances I do not think the Court can pay any respectful attention to their suggestion in the alternative that if they were compelled to hold that the offence had been committed they would then proceed to say it was trivial. I agree, therefore, that we should say the offence in this case was not trivial and that it ought to be remitted to them to convict, with the consequential order my Lord has mentioned.

Mr. Justice Swift : I agree.

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Foot-and-Mouth Disease.—An outbreak was confirmed on October 27 at Westmeston, Hassocks, East Sussex, and the usual restrictions were applied to an area of approximately 15 miles radius round the infected premises. Five further outbreaks, the last of which was confirmed on November 8, have occurred on premises in the same locality as the original case.

There was no spread of infection from the outbreaks at Chardstock, Devon, and at Chartham, Canterbury, Kent, referred to in the November issue of this JOURNAL, and the infected area restrictions imposed in connexion therewith were accordingly withdrawn on November 8 and 19 respectively.

There have now been 35 outbreaks since January 1 last, involving 13 counties and the slaughter of 1,174 cattle, 1,054 sheep, 1,156 pigs and 4 goats.

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NOTES FOR THE MONTH

The Government and Agriculture SPEAKING at the Joint Annual Dinner of the Farmers' Club and the Central Chamber of Agriculture on December 10, The Rt. Hon. Noel Buxton, M.P., Minister of Agriculture, said that he fully appreciated that some sections of agriculture were passing through a most difficult period, but he did not agree with the view which, he believed, was still held by many agriculturists, that the only real remedies for agricultural depression were protective tariffs or subsidies. In any case, whether one held that view or not, it was abundantly clear that no such measures would be introduced by this or, so far as he could see, by any alternative Government. There was, however, ample scope for helpful activity even within the limits set by the present political situation.

The Government were directing their efforts towards the securing of a fair return to the farmer, and an adequate wage for the worker. Dealing first with the Government's proposals for assistance to farmers in regard to production, Mr. Buxton said that grants had already been made available for field drainage and water supply schemes. Above all, there was need for co-ordinated activity in dealing with the problem of arterial land drainage. This would be made possible by the land drainage legislation which was in preparation, and would be introduced at the earliest possible moment.

The importance of education and research should, he felt, need no emphasis nowadays. He had reviewed the position and had come to the conclusion that there were several directions in which these services should be extended. In particular, facilities for agricultural education in the counties were very unequally distributed over the country. There was urgent need for "grading-up" the backward areas. He had recently informed County Councils that the Ministry was in a position to pay its two-thirds share of any further approved development

in this work, and he earnestly hoped that Local Authorities would take advantage of this opportunity. Further provision was needed for the agricultural education of women, and the whole of the existing system of education and research on the very important subject of animal diseases needed overhauling and reorganizing. All these schemes would cost money, and a special capital grant of £500,000 had been made to the Development Fund for these and other purposes. There was a serious gap in the present system of economic research, and the Government proposed to fill it by instituting a farm management survey on a large scale which would, he trusted, produce results of very great benefit to the industry.

The provision of rural telephones had proceeded more rapidly during the last few months than ever before in the history of telephone development in this country.

Village amenities were receiving special attention, and the fund for giving assistance by way of loans towards the erection of Village Halls had been increased by £20,000 and had been made available for the whole of England and Wales instead of a few counties as heretofore.

The interests of the worker had been borne in mind. Provision had been made by increasing the number of inspectors under the Agricultural Wages Act for improving the administration of that measure, and he was engaged with the Minister of Labour in an earnest endeavour to evolve a sound scheme of unemployment insurance for agricultural workers.

Mr. Buxton then said that the keynote of the Government's agricultural policy was marketing reform. Not only were they pressing forward with schemes for standardizing, grading and marking of agricultural produce, which had already brought very substantial benefits to the agricultural producer, but they proposed to institute an active exploration of the vast and hitherto neglected field of organization. An additional sum of £12,000 a year from the Empire Marketing Fund would be devoted to this work. He had arranged to offer easier terms to co-operative enterprises desiring loans.

There had been a striking change during the last few years in the attitude of the farming community towards proposals for marketing reform, and he felt sure that we were still only on the threshold of very great developments in that sphere. The movement had already achieved a considerable momentum, and the Government would spare no effort to accelerate it.

Drawing attention finally to the proposed Conference for the discussion of agricultural problems, Mr. Buxton contended

that the Government's activities afforded ample evidence of its concern for agriculture, and represented already a considerable contribution towards the well-being of the industry.

* * * * *

DURING December the Ministry issued an interim report, by the Pig Industry Council, on the Commercial Pig (Marketing Leaflet No. 15, obtainable from the

The Commercial Ministry, 10 Whitehall Place, S.W. 1).

Pig In giving publicity to this report, the

Ministry desires to commend its conclusions to the consideration of farmers. It was neither practicable nor necessary to print all the evidence on which the Council based its conclusions, but one document which formed part of the evidence seemed particularly worthy of publication. This document, which appears on pp. 945-9 of this issue, and which is signed by all the representatives of the curing and pork trades who are on the Council, is a pronouncement of trade requirements. A mere pronouncement of trade requirements, of course, has its limitations, for it is not concerned with factors such as economy in feeding and prolificacy. Within those limitations, however, its authoritative nature is testified by its signatories, and it is deserving of careful study by all pig breeders and feeders.

* * * * *

VACCINE for the protection of birds against Fowl Pox is now being issued by the Ministry's Veterinary Laboratory, New Haw, Weybridge, Surrey. As the

Fowl Pox vaccine is still in the experimental stage

Vaccine it will be issued free, and for the present

can be obtained from the Ministry's Veterinary Laboratory, or through County Poultry Instructors. Fowl pox is the disease in which wart-like nodules occur on the unfeathered parts of the head, and adherent, yellow, cheesy membranes in the mouth. The mouth lesions are sometimes erroneously referred to as fowl diphtheria.

The vaccine protects birds against fowl pox only, and is of no value against other diseases. As each bird is caught for inoculation, the comb and mouth should be examined for lesions of the disease, and if any are found the bird should immediately be killed.

The vaccine should be used only on apparently healthy fowls. As it does not confer immediate protection, fowls

should be protected from infection, as far as possible, for 21 days after inoculation.

In dealing with fowl pox, as indeed with all contagious diseases, strict attention should be paid to the cleanliness and disinfection of houses and runs.

Fowl pox virus is very resistant, and strong measures are required for its destruction. The first and most important part in the disinfection of an infected building is the cleaning of the interior by scraping and sweeping. The droppings, scrapings and litter should be burnt, or mixed with quicklime, and removed from contact with fowls. The walls and roosts should be scrubbed with hot water containing caustic soda (10 per cent.) to remove all dirt and grease. This also acts as a disinfectant. The house may then be washed or sprayed with a reliable disinfectant. The infected runs should be top-dressed with ground quicklime at the rate of two tons to the acre and, where practicable, ploughed up and left vacant for six months. Dead birds should be burnt or buried in quicklime.

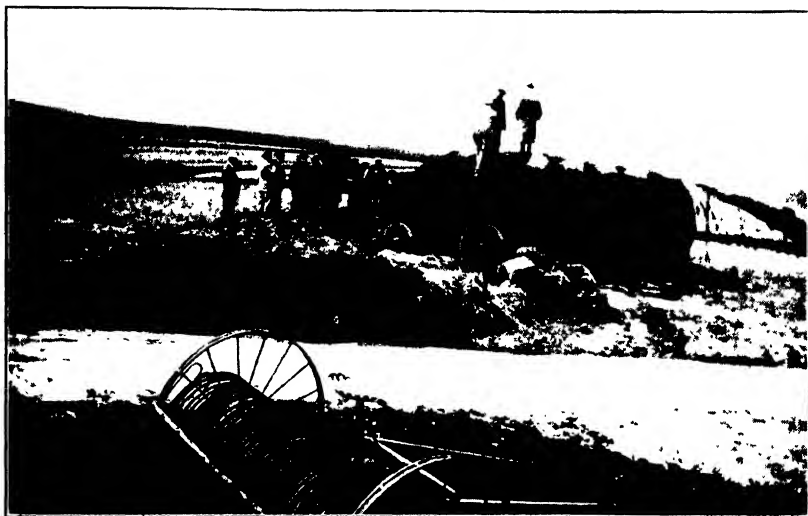
* * * * *

MANY thousands of tons of surplus potatoes of the 1928 crop were wasted, no suitable methods of making profitable use of them being known to the farmer.

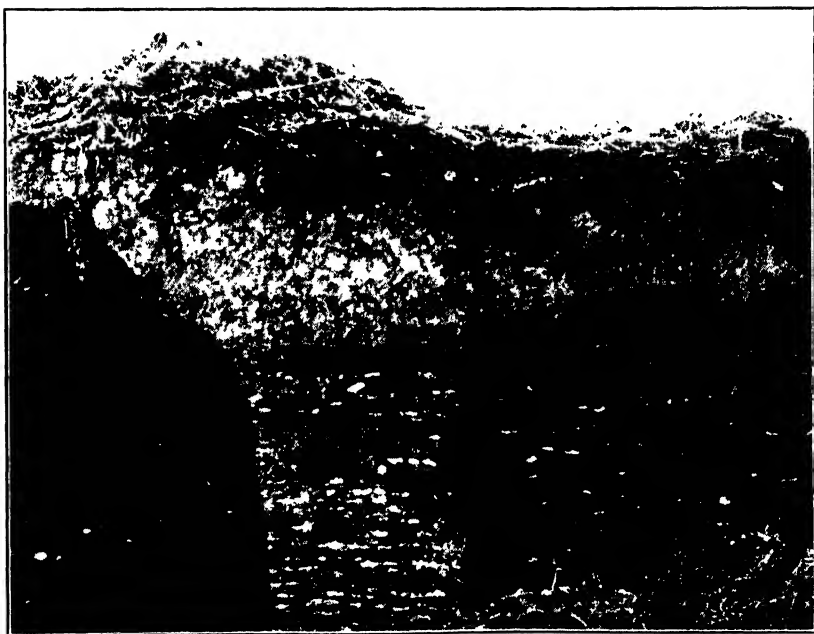
Potato Silage

Other countries have devised various means of utilizing surplus potatoes, one of which is the making of them into silage. Mr. J. C. Wallace, Principal of the Agricultural Institute and Experimental Station at Kirton, near Boston, Lincs., has communicated the following particulars of the method successfully tried in Holland in 1923, and practised on a considerable scale in 1929 as a means of preserving what remained of the 1928 crop as food for stock.

The method consists of using newly-mown pasture grass, and mixing it with potatoes in a stack silo. No building or excavation is required, the grass and potatoes being built up on the ground level in the form of a stack. First of all a layer of grass is placed on the ground, then a layer of potatoes on the grass, followed by another layer of grass, and so on until the stack is completed, when a covering of a foot or so of soil is placed on the top. Excellent silage is produced in this way, the potatoes coming out in what appears to be a partly-cooked condition.



A Potato Silo in Friesland, Holland, being inspected by a party of English farmers.



Potato Silo in the Holland Division of Lincolnshire. The view shows the silo in section, with the layer of soil on top of the silage, and, above that, rough grass mowings and dyke trimmings.

The diameter of the stack will depend upon the amount of material to be ensiled. In Holland, round stacks of about 4 or 5 yards in diameter are usual. The proportion of grass and potatoes used in Holland is generally about 3 tons of green grass to 1 ton of potatoes, but the results of experiments here indicate that the proportion of grass can be considerably

ad. The layers consist, approximately, of $1\frac{1}{2}$ tons of green grass and $\frac{1}{2}$ -ton of potatoes. The potatoes are not treated or prepared in any way, but in the event of their being badly sprouted, they would be dressed through a riddle in order to remove the sprouts.

It may be noted that no pressure is applied to the stack while it is being built. In England, when making stack silage, the stack is usually built in such a way that carts can be drawn on to it, so that it can be compressed as it is built up. In Holland, however, the stack is built in the same way as a hay stack, and for quite a number of days has the appearance of a half-built stack. This method is successful in Holland because the stack takes a good many days to build. In England, the farmer usually attempts to build a stack silo in a day or two, and unless pressure is applied as the stack is being built, the height would become too great for convenient working. The Dutch, however, are small farmers, and labour is not too plentiful on most farms. On the dairy farms, where most of this type of silage is made, the men, if any are employed, have certain other routine work to do—milking, attending to stock, etc.—so that there is not much time available each day for mowing and carting the grass and potatoes. The result is that the stack is added to slowly, and it has plenty of time to settle gradually. The weight of each layer of potatoes also helps to compress the grass. Better silage is, of course, obtained in this way than when the stack is built up rapidly.

A successful experiment to make potato silage in the way described above was undertaken last June in the Holland Division of Lincolnshire. The making of stack silage is not now uncommon in this part of Lincolnshire. The stack is made in such a way that it can be compressed by carting over it as it is built up, and instead of being covered with soil, a heavy covering of straw is employed.

In the experiment referred to above, the stack was made so that carts could be drawn on to it. The produce of a five-acre field of clover "seeds" (broad red clover with a little ryegrass) was used in the making of the silage. This would yield probably 40 to 45 tons of "green" clover. The quantity

of potatoes used was 30 tons. The proportion of clover to potatoes was much less than is used on the Continent, but excellent silage was produced. The top of the stack silo was covered with about a foot of soil, but no protection was given to the sides.

Arrangements are now being made for a feeding trial with this silage, at the conclusion of which a full report will be issued.

* * * * *

THE following note has been communicated by Mr. A. W. Oldershaw, B.Sc., Agricultural Organizer for East Suffolk :—

An inspection of the grass land in **The Improvement of Poor Grass Land** various parts of the country reveals the fact that much of it is in a very neglected and impoverished state. A great deal has been written upon the intensive treatment of grass land by nitrogenous manuring and otherwise, but large areas of our grass land have not reached the stage of even moderate productivity, and are not ripe for intensive treatment. The conditions under which grass is grown in various parts of the country are so varied that it is impossible to do more than indicate general methods by which improvement may be effected. Special local problems are constantly arising, and advice upon them should be obtained from the County Agricultural Organizer.

Much of the work necessary in the improvement of grass land may be best performed in the autumn and winter months, so that the present is a suitable time at which to consider the question. Poor heavy clays may usually be greatly improved by mole-draining and by the application of phosphatic manures. In the eastern and midland counties of England, where the rainfall is comparatively low, the best results from manuring will usually be obtained from the use of basic slag of high solubility, or from superphosphate. In districts of higher rainfall, slag with a lower solubility will generally answer well, whilst equally good results at a rather lower cost per acre may often be obtained from applications of very finely ground North African phosphates. This material has given much better results since very fine grinding has been introduced. At present prices, an expenditure of from £1 to 25s. per acre on phosphatic manures for poor heavy grass land may be relied upon to give increased produce during the three or four years following the application, worth two or three times the sum expended.

In certain parts of the country, large areas of low-lying and boggy grass land exist. Often this is very wet, and more or less covered with rushes. It has been found that a generous application of phosphatic manures will frequently effect a most remarkable improvement in such land, causing an abundant growth of clover under what are apparently most unfavourable circumstances. Those occupying wet and boggy marshes would be well advised to put down a trial plot, on a small scale, although the prospect of success may seem at first sight to be small.

Where the soil is black or somewhat sandy the addition of potash manures to the phosphates not infrequently makes for marked improvement.

Rather light and medium grass land may usually be greatly improved by a dressing of phosphates and potash together.

Where the land is not too light, 6 to 8 cwt. of medium quality slag and 4 cwt. of kainit per acre will commonly be found useful, and in a season of ample rainfall an abundant growth of wild white clover will often result from such an application.

In general the less soluble forms of phosphates, such as North African phosphates and basic slag, are rather slow in their action, and in dry districts or a dry season often fail to give much result until the second year after application. On the other hand, superphosphate will usually have a marked effect the first season.

There exist large areas of grass land in this country on which the simple methods of improvement above indicated fail to give satisfactory results. One of the most frequent causes of failure of phosphate to act is the presence of a thick mat of vegetable matter on the surface. This mat may be two or three inches thick and it acts as a sponge to absorb moisture, preventing the satisfactory growth of the better grasses and clovers. The mat is usually due to poverty of the soil in lime. A heavy application of that substance in some form, especially if combined with tearing and opening up of the surface by mechanical means, has been found to give very satisfactory results in many instances. Usually the grass land in question is of a very poor type, and the plan of ploughing up—simply inverting the turf—adding lime and phosphates and immediately re-seeding with a mixture including wild white clover, has been tried with great success in some cases.

In the improvement of pastures, the importance of good grazing can scarcely be over-estimated. Horses are bad

grazers and should always be accompanied or followed by cattle, or clumps of coarse grass will accumulate. Once in the year at least, the land should be thoroughly bared down to the soil. This gives the wild white clover a chance to develop and prevents the accumulation of inferior herbage, which stock will not eat.

Perhaps most agriculturists are fully aware of the great improvement in grass land which can be effected by the methods indicated above. In some cases it may be that lack of capital is the reason why no action is taken. In others it may be due to a failure to realize the profitable nature of judicious expenditure upon the comparatively inexpensive manures or cultivations mentioned. Of the various suggestions made, the application of lime, and ploughing up and re-seeding, are the only plans which will involve an expenditure of more than £2 per acre.

It seems unlikely that any capital invested in farming operations at the present time will give a greater annual return than that put into the judicious improvement of poor grass land. In addition to that, the production of a larger quantity of more nutritious grass will undoubtedly tend to lessen necessary expenditure upon concentrated foods, so that the net result of grassland improvement may very well be that less and not more expenditure is necessary.

* * * * *

CATTLE improvers whose interest is in beef production may be rather attracted by an unusual experiment which has been going on in Canada for some years. The

Hybrid Cattle in Canada

problem was to develop a good beef breed in a rigorous climate where pasture was hard to find, so it was decided to try crossing Angus, Hereford and other European beef breeds with the native Canadian bison. At first the experiment was not very successful, since births of male calves resulted in a very high percentage of mortality, both of cow and of calf, and the males that lived were sterile. The female hybrids, however, were successful animals, fertile to either bison or domesticated bull, able to "rustle" for themselves in bad weather and on scanty pasture, and producing a very good grade of beef, somewhat like that of the Aberdeen-Angus. Moreover, crossing these hybrids among themselves produced an F_2 generation (called a "cattalo"!) which exhibited the useful qualities of the first-crosses. Fairly recently, a further experiment has been tried on these lines, with the idea of

avoiding the high mortality consequent upon the first-cross. Some Central Asiatic yaks were introduced and mated with bison and with European cattle, and the hybrids mated in various ways thereafter. Here there was no mortality, and the animals flourished, being described as "singularly rugged and hardy." The experiment is still in too early a stage to say what are the commercial possibilities, but the breeding experiments are certainly interesting, and have indeed resulted in F_2 and F_3 generations, some of the animals even containing European, bison and yak blood. The dominance of the white face of the Hereford is a noticeable feature of the queer-looking animals produced.

* * * * *

To meet the demand for information as to the best methods by which fruit and vegetables may be preserved for use when fresh material is not available, the workers at the University of Bristol Research Station, Campden, Gloucestershire, at the request of the Ministry, have compiled a publication* on the subject of preservation generally. The methods recommended

**Domestic
Preservation
of Fruit and
Vegetables**

and the recipes given are those which the workers at Campden have found, after repeated testing, to give the best results. They are the most reliable methods known at present, and they are simple—such as can be carried out in any ordinary household. The writers have recognized the value of many of the traditional recipes which have been practised by housewives from early times, and have embodied such recipes, modifying them where necessary so as to conform with the principles now known to be the basis of the practices. The resulting volume should prove of service generally to all who grow fruit and vegetables, or who can readily acquire cheap supplies for preservation purposes.

* * * * *

THOSE of us who can look back over thirty years on the problem of the scientific feeding of stock, note some striking advances. In those days Kühn's and Wolfe's books were the chief guides for students, and albuminoid ratios were emphasized in all lectures on feeding.

**The Master's
Eye**

Kellner's investigations, followed by the work of Wood and

* Miscellaneous Publications, No. 69, "Domestic Preservation of Fruit and Vegetables," obtainable from the Ministry, 10 Whitehall Place, London, S.W. 1, price, cartridge covers, 1s., quarter-bound, 1s. 6d., post free.

his associates, opened up a new field, with concentration on starch equivalent and balanced rations. Educationists have accordingly preached far and wide the gospel of balanced rations, and as a result farmers are giving greater attention to the economics of stock-feeding, which is all to the good. Further, manufacturers are putting on the market balanced concentrates for special purposes. Balanced concentrates, whether home-produced or purchased, are being fed at the rate of $3\frac{1}{2}$ lb. per gallon of milk. This all sounds very simple to the beginner, but its very simplicity will scarcely be conducive to the best results if other considerations are not borne in mind.

Albuminoid ratio, starch equivalent and balanced ration are all good as far as they go, but they are not the be-all and end-all of successful stock-feeding. It is said that one man's meat may be another man's poison—and stock, like human beings, have their idiosyncrasies. Farms differ, pastures differ, foods differ, hence to a considerable extent—a greater extent than is generally imagined—it is the master's eye which feeds the stock. Local conditions, foods available, cost per food unit "on the farm," the difference between the sale value of home-grown produce and the price of purchasable feeding stuffs—all these need to be taken into account. The constant vigilance which is practised by the most successful feeders is always necessary if the best is to be obtained from any foodstuff, whether home-grown or purchased. Such care is especially necessary at the present time, owing to the scarcity of hay and roots in many districts.*

* * * * *

INFORMATION of an interesting nature regarding the use made of this JOURNAL in connexion with Norfolk Elementary Schools has recently come to hand. The

The "Journal"
in Norfolk
Elementary
Schools

Local Education Authority of this large agricultural county has for some time catered for the needs of the rural districts, where about 50 per cent. of the boys find employment on the land after leaving school, by including a course in rural science in the schools' curriculum. In addition to the usual school gardens, many schools are now provided with an agricultural plot, on which small demonstrations with such crops as sugar beet, mangolds, kohl rabi, soya beans, potatoes and cereals are carried out.

* Points of importance in the feeding of the different classes of stock and methods of calculating rations are given in the Ministry's "Rations for Livestock," price 6d., post free.

A further development took place when a scheme was introduced whereby copies of this JOURNAL are issued to a number of approved schools in these rural areas. This step has been attended with remarkable success, as it has been found that the JOURNAL serves a fourfold purpose. As a teacher's reference book it was found to be a valuable supplement to the usual text books on rural science, as it contains a great deal of new and first-hand information. It is also consistently used by the members of the senior departments of the schools for "self-study" work, and the various articles often form the basis of class work. The parents of the scholars, who are mostly land workers, are permitted to borrow the JOURNAL, and frequent use is made of this privilege. Lastly, the complete volumes are bound and placed in the school reference library.

Typical examples of letters regarding the use made of the JOURNAL are two from Mr. Fredk. Jago, Head Teacher at Gayton School, and Mr. Frank S. Wigg, Head Master of Fakenham Boys' School. The former, writing on September 20, 1929, observes that he finds the Ministry's JOURNAL very useful indeed both in the school and in the parish, for the following reasons :—

- (a) As rural science is taught in the school, up-to-date information can be obtained from it, both for teacher and scholar. As boys read and study it in school, they are taught, when requiring information, to turn it up in the JOURNAL, and the habit remains after leaving school, when they will often ask for the loan of the JOURNAL.
- (b) From the publicity given sometimes, in conversation with their employers, the employers themselves will often ask for information, or loan of the JOURNAL. This is often the case with smallholders, whose sons are educated at the school.
- (c) As the most recent knowledge is obtainable from the JOURNAL, progressive land workers will often discuss recent observations and experiments with the Head Teacher. As several experiments have been tried in the school gardens, farmers and others have taken a very keen interest in their development, and some have asked for specified experiments to be done in the school garden for observation purposes.
- (d) Many old theories die hard in the farming areas, and when contradicted, often lead to discussion, and the

JOURNAL acts generally as an authority from which to quote, especially with regard to up-to-date methods of cultivation, manuring, fallacies regarding insects, etc.

- (e) By the warnings about and treatment against insect pests, current in any particular month, much good can be done by study of the JOURNAL by scholars, who warn parents and discuss with them methods to meet the trouble, especially with regard to fruit.
- (f) The scholars are very keen to read, and study the JOURNAL, and boys can often be found, when given choice of reading matter, to choose the JOURNAL.
- (g) If copies are retained, an excellent reference library on general agricultural subjects is to hand.

Altogether, Mr. Jago personally finds the JOURNAL to be one of the most useful reference books for a rural school.

Mr. Wigg states that the JOURNAL has been of general interest by illustrating such practical things as (a) marketing of fruits and vegetables ; (b) insect pests and their remedies ; and (c) operations in connexion with land and fruit culture, etc.

He has further found it of special interest in helping with the agricultural plot. In 1928 wheat was grown, and this year kohl rabi and sugar beet. The sugar beet was treated with five different kinds of manures and the results proved interesting and encouraging.

* * * * * *

ACCORDING to returns made to the Ministry by the beet sugar factories operating in Great Britain, the quantity of home-grown beet sugar manufactured during October and November, 1929, together with the quantity produced during the corresponding months

Production of Home-grown Beet Sugar		in 1928, was :—	
		cwt.	cwt.
October, 1929 ..	1,456,608	November, 1929 ..	2,051,965
October, 1928 ..	828,623	November, 1928 ..	1,579,631

The total quantities of sugar produced during the two manufacturing campaigns to the end of November were :—

						cwt.
1929-1930 ..	..	..	..	..	..	3,520,477
1928-1929 ..	..	..	..	..	..	2,414,480

THE IMPERIAL SOIL BUREAU*

SIR JOHN RUSSELL, D.Sc., F.R.S.,

Director of the Bureau, and of the Rothamsted Experimental Station.

IN recent years there has begun an important movement towards organized development of the Empire. The problem is complicated by the wide diversity in conditions of the different parts of the Empire, and by the fact that some of its units are entirely self-governing, so that organization has to be a matter of mutual agreement and must proceed along lines representing the greatest measure of common consent.

The Empire depends largely on its agriculture; indeed, in the main it can be called an agricultural Empire. There is as yet no imperial organization on the business side, but on the scientific side the organization has been developing. In the nature of things the scientific agriculturists of the Empire are widely scattered; many of them are remote from libraries and laboratories and cannot keep in touch with modern investigations elsewhere. Even workers in large, well-equipped institutions, provided with good library facilities, find this difficult; modern agricultural science is so intricate and specialized that no one man can claim a knowledge of all of it; sometimes, indeed, the specialists in the different branches can hardly understand each other's language. This is a recent development: when Warington wrote *The Chemistry of the Farm* in 1881 he could safely deal with the whole subject; no one who knew much about it would attempt to do so now.

The difficulty is accentuated by the fact that agricultural science is now being developed in a large number of different countries. The wave of nationalism that has passed over the world since the war has led to the revival of languages not previously used for scientific or literary purposes. Before the war practically all the important work in agricultural science was published in about six languages—English, French, German, Italian, Dutch and Scandinavian; as most of the workers could read at any rate the first three or four it was possible to keep in touch with all that was going on. To-day the Rothamsted library receives journals on agricultural science in more than twenty languages, and any of these papers may be important. Although scientific workers have from time

* This is the second article of a series dealing with the work of the new Imperial Agricultural Bureaux. The first article was published in this JOURNAL for August, 1929, p. 461.

to time threatened to learn no more languages the journals continue to appear. The quality of the work is unequal: some is poor, especially when, as happens in places, men are appointed to agricultural colleges solely on the score of nationalism and not of efficiency; but some is good, some very good, and all must be examined.

Now it is palpably impossible for the agricultural expert, busy with his own problems, to read all this enormous mass of literature in so many different tongues. It is equally impossible for him to leave it alone, for economic conditions everywhere require that the farmer should be given all the technical and scientific help possible. The work must be done for him. It was therefore decided at the Imperial Agricultural Research Conference in 1927 that several Bureaux, additional to those already functioning, should be started in Great Britain to supply workers in each part of the Empire with information about investigations elsewhere and also to keep each one informed of what the others are doing. One of the new Bureaux was for the study of soils. It was started at Rothamsted on May 1, 1929, with the writer as Director and Dr. A. F. Joseph, late of the Sudan Government service, as Deputy Director. Dr. Joseph is assisted by Miss H. Scherbatoff, a Russian lady with a thorough knowledge of some six or seven languages and a good working knowledge of several others, and by Mr. A. J. Lloyd Lawrence, formerly of Caius College, Cambridge.

The first duty of the Soil Bureau as laid down in the memorandum of foundation is to maintain an index of the researches being carried out in different parts of the Empire and as far as practicable in foreign countries, and also to collect information from all sources relating thereto.

Its next duty is to distribute information about soils to officials and advisory officers in all parts of the Empire. This information includes bibliographies and photostat copies of papers or tables; where possible the loan of papers.

At the moment no printed journal or bulletin has been sanctioned, and the distribution of general information is by typewritten circulars. Experience will show how far this method suffices.

Although fertilizers are not specifically mentioned in the foundation memorandum, they are so closely related to soils that we regard them as coming within our purview, and this is the more readily done since Rothamsted is the home of fertilizer experiments.

The compiling of an index of research on soils and fertilizers in the Empire is now well in hand. The information, when assembled and classified, should prove very valuable.

Several memoranda have been circulated already to the soil workers of the Empire. Being intended only for experts they deal with highly technical subjects, but they summarize information which is not easily accessible; their general purpose is to help with the unification of methods of soil analysis. Till recently there was no agreement; each worker chose whatever methods he liked. The result was that a soil analysis made in one country did not necessarily mean the same thing as an analysis made in another; two different soils could give the same figures, and one and the same soil could give different figures according to the particular methods used. This greatly diminished the value of the analysis, because it obscured resemblances and relationships that might have been helpful to the investigators.

In the last few years a considerable amount of agreement about mechanical analysis has been reached by soil workers, and an international method has been drawn up and used sufficiently to reveal some of its advantages and disadvantages. The Empire soil workers, however, have not all adopted it, preferring to wait and see how it turned out.

The first memorandum issued by the Bureau dealt, appropriately enough, with this proposed method, pointing out the types of soil for which it has not proved satisfactory, the difficulties already discovered, and the ways in which some of the difficulties have been overcome. References are also given to some of the critical papers.

The second memorandum dealt with another analytical process about which there is as yet no international agreement: the determination of the organic matter in soils. The various groups of methods are set out, particularly a new and simple one which may prove of general interest.

The third memorandum directs attention to the desirability of making a soil map of the Empire, as one of the essential requisites for organized development of Imperial agriculture. While adequate methods of classification are as yet undeveloped, and in consequence the necessary basis is incomplete, sufficient is known to allow of a satisfactory beginning. An actual illustration being better than any amount of *a priori* discussion, a recently constructed soil map of the Sudan was circulated also. Concrete suggestions are made for a soil survey of the tropical parts of Africa coming within the

Empire, and the services of the Bureau staff are offered for the collation of the results.

Other memoranda are being drawn up for circulation on soil erosion, green manuring, field experiments, especially methods of lay-out and treatment of results, soil classification, determination of soil alkali, clay; all these being of importance to large parts of the Empire. At present these are circulated, in accordance with the foundation memorandum, through the official correspondents in each part of the Empire; they are not sent direct to the actual workers. Whether this method will continue remains to be seen.

In addition, the Bureau is drawing up a list of periodicals, including Reports of Experiment Stations, that deal with soil and fertilizer problems; this list will be available to all workers.

A considerable amount of time has been spent in answering inquiries. These come in direct from the soil experts and necessarily involve a great deal of labour in collection and critical examination. Among the inquiries have been several on the effects of manganese in soils, on erosion, laterites, silicates, and different aspects of soil analysis. They have come from various countries of tropical Africa—the Sudan, Kenya, Uganda, Sierra Leone—from Palestine, Burma and Ceylon, from Quebec, also from England—which as part of the Empire is also to be served by the Bureau.

The Bureau will also help soil workers proposing to visit England, furnishing introductions and itineraries, arranging with universities or other organizations in this country for anything desired from post-graduate study to short visits taking only a day. Further, it informs soil workers of conferences likely to interest them, and generally adopts whatever steps lie in its power for helping all who are engaged in studying the soils and growth of crops in the British Empire.

The staff are very anxious to do all in their power to make the Bureau an effective and useful organization for the development of the agriculture of the Empire, and they cordially welcome suggestions from Empire workers indicating other services which the Bureau can render.

AGRICULTURAL EDUCATION : PRESENT NEEDS AND LARGER AIMS*

J. HUNTER-SMITH, M.C., B.Sc.,
Principal, Herts Institute of Agriculture.

It is not intended in this paper to give an historical account of the growth and development of agricultural education, or to discuss in any detail the multifarious activities of agricultural education authorities at the present time. Suffice it to say, that in the years immediately succeeding the Great War there took place a very substantial expansion of both agricultural education and agricultural research. Evidence of this is seen in the greatly extended facilities afforded by local authorities for those engaged in or taking up any form of agriculture ; in the larger staffs employed ; in the establishment of several Farm Institutes ; and, as a consequence, in increased local and national expenditure. Agricultural research has, in fact, been completely reorganized, and is now not only comprehensive in its scope from a national point of view, but is being developed on still more comprehensive and imperial lines. Such progress is, indeed, gratifying, as it shows that our basic industry is beginning to receive the attention and study which its importance merits and demands. Reflections with regard to agricultural education suggest, however, that recent extensions represent rather the occupation of strategical points than a concerted attack, and the examination of this point of view is the subject of this paper. What are the purposes, the underlying ideals of agricultural education ? What is the scope of agricultural education ? These are fundamental questions more easily asked than answered, and the temptation is strong to adopt a sequence of negatives. For example, it might be said that agricultural education is *not* a device for giving " tips " on manuring, on feeding, on varieties of crops, etc., to those farmers who are prepared to accept them. Nor is agricultural education concerned solely, or even mainly, with giving popular lectures or free advice about the place and value of science in agriculture, and so on. Such negatives may have considerable force, but a real grip of the position is possible only by the positive method. For this reason direct answers to the questions are attempted in the following three statements, thus giving to agricultural education a much wider sphere of influence than is usually accepted :—

* This paper was read at the Public Works, Roads and Transport Congress (1929), but has since been revised by the author.

- (a) To stimulate in both urban and rural districts a genuine love of the country-side.
- (b) To secure individual and collective efficiency in all rural pursuits.
- (c) To promote mutual understanding between town and country.

The first and last of these aims are not usually associated specifically with any organization, although it is difficult to dispute their importance. What could be more appropriate than that those who are engaged in agricultural education, and who are already acquainted with the countryside, should accept the responsibility and privilege of giving an inspiring lead in both directions ? Measured in terms of increased output from the land, the results would no doubt be meagre, but measured in terms of real education, cultural and national well-being, the results might be magnificent. What better antidote to the monotony of factory routine than the ability to enter fully and intelligently into all the joys and interests of the country ? If such a view may be taken with regard to those engaged in industry, how much more does one expect that the rural worker shall be equipped for an even fuller reverence and appreciation of his environment. But seldom in town or country is the education of the young, or of the adult, adequately directed to achieve these or similar results. This is doubtless one of the circumstances which aggravate the cleavage already existing between town and country, and, if our ideals are sound, it is in the bridging of this gap that aid may be given through agricultural education. In other words, the activities of the country side, and the fullness of the insight it provides into life and living processes, should become a bond of union. The strengthening of this bond depends, not so much on an improved system of rural education, as on creating, through education, interest and mutual understanding. To achieve such a result requires an outlook which, while acknowledging a common debt to the country for pleasant days, for health, and for inspiring educational material, recognizes also the indispensable partnership of agriculture and industry. Recognition of this partnership is of fundamental importance to the national well-being.

Technical efficiency in rural pursuits is clearly the special responsibility of agricultural education. More is, however, involved than helping farmers and their sons, more also than promoting the efficiency of farm labour and rural crafts, and more also than the application of science to agriculture. There

is, above all, the development of collective efficiency within the industry. How much or little has been accomplished in these various directions may perhaps be left to the reader's imagination.

Now turn to more concrete matters—the consideration of ways and means. This may, perhaps, be best done by submitting a diagram (p. 933) to bring out clearly just where we stand at present so far as agricultural education is concerned. This diagram is intended to show three things, (1) the strategical strong points already referred to (in heavy lines), (2) the weak points marked X, Y and Z, and (3) the whole scope of agricultural education (within the dotted line). The top half of the plan shows a stage in the development of agricultural education which may shortly be reached, while the bottom half depicts a co-ordinated scheme. In the former, agricultural education is still discontinuous and the tendency for rural pupils to drift to the towns is plainly seen. In the latter, the educational opportunities are continuous, and organized absorption from the towns is possible.

The strategical points are the Farm Institutes, the new type of Rural Central Schools (which it is assumed will shortly come into being), and the Colleges and Research Stations. These are the key positions. The chief weak points, or salients, are the absence of Rural Secondary Schools, (X) in the diagram, and the absence of organization at the points (Y) and (Z). This diagrammatic representation of the position shows at a glance the strength and weakness of the present system. Further discussion of the subject can now be pursued conveniently under three headings: The Rising Generation, The Farm Institute, Research and Agricultural Education.

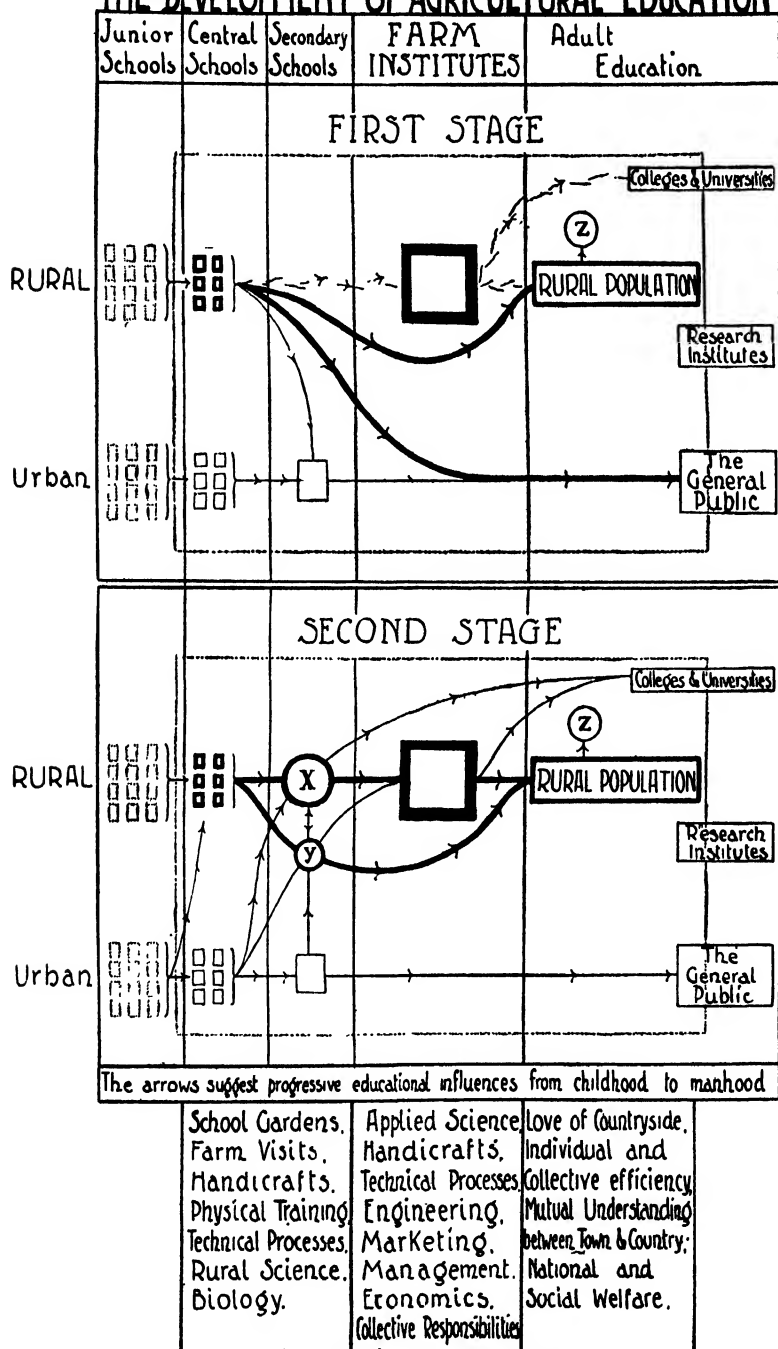
The Rising Generation.—Country lads who intend to follow in their father's footsteps as horsemen, stockmen, smallholders, etc., get very poor opportunities of becoming really interested in their environment or efficient in their calling. They attend the village school until they are 14 years of age and then, in the majority of cases, cease to be connected in any organized way with educational facilities. The school attended by these may have had all the moral and educational disabilities that are associated with small, ill-equipped establishments where all grades of pupils are under the care of a staff of one or two teachers. There may or may not be a school garden, and there may or may not be handicraft instruction. Too often the poverty of environment and barrenness of opportunity are such as to offer the pupils educationally a very poor start in life.

Later progress and efficiency, if happily forthcoming, are mainly the results of chance possibilities after leaving school.

Fortunately, the possible application of the recommendations of the Hadow Report (so urgently needed in Rural Districts) and the raising of the school age to 15 years, are likely to stir up hopes (as well as misgivings) with regard to the whole subject of rural education. To extend the present system would be disastrous, whereas reform, which would leave every village with its Junior School and establish efficient, well-equipped Rural Central Schools, might and ought to become a very real blessing. The result, for good or ill, depends on securing a suitable balance between the true kind of intellectual instruction and appropriate handicraft work. These school activities, thus vitalized and throughout intimately associated with thought and endeavour, must become a widening stream of practical, cultural and environmental experience, and thereby a perfect means for the development of these young human personalities. Thereby will be derived appreciation and control of their surroundings through the joy of successful creative endeavour. In other words, the process offers a true education for life, as well as for a livelihood. The proper educational use of the country-side offers abundant materials for the development of æsthetic, literary, and practical qualities of the highest order. It provides scope for the most fascinating lessons in handicraft, and for cultivating, by practice and effort, the spirit that delights in work well done for its own sake. No urban school has so few drawbacks or so many opportunities of developing character. There need be no artificiality, and thus education becomes an instrument for developing all the best powers of body, mind and soul.

Such fruitful ground has not been entirely neglected. A beginning has been made, of which the following particulars from Hertfordshire are examples. The Rural Syllabus of the Herts Education Committee enables boys and girls from certain elementary schools to make organized visits to neighbouring farms, to ploughing matches, blacksmith's shops, etc., thus introducing everyday events of the countryside into the school curriculum in an appropriate way. There are 120 school gardens in the County, and these are under the advisory control of the Agricultural Education Sub-Committee. Special courses of instruction in horticulture are held annually for teachers who are in charge of school gardens ; all the necessary artificial manures are supplied by the Institute to each garden in the correct proportions and quantities ; similarly, certain spraying

THE DEVELOPMENT OF AGRICULTURAL EDUCATION



materials for the control of pests on fruit trees are provided ; fruit trees on different stocks, bush fruit, herbaceous plants, flowering shrubs, etc., are also issued. These provisions make it possible for each garden to be not only a rural laboratory of the best kind for the children, but also a centre in which parents and villagers can be interested, and where, among other things, they can observe manurial, spraying and other tests and operations. It is surely the right way to begin ; the sure way of stamping out prejudices which die hard in the country, and the most certain road to future progress, actually to show what is being done. Children, teachers, parents and onlookers all see results with their own eyes, and agricultural education accomplishes her first triumph.

In these directions, however, only a beginning has been made, and much more is needed to make this worth while. The raising of the school age will bring increased responsibilities and opportunities. It is a critical step—with elements of danger, yet with great possibilities of making a stride forward towards the fuller realization of our ideals. Agricultural education must here contribute more than mere technical advice. There is much to be done in establishing the biological background, through rural teachers inspired with the enthusiasm of the naturalist. Assistance will also be required on the practical side, in co-ordinating physical training with handicraft and manual processes, and in securing opportunities to give instruction in rural craftsmanship. Many lads can best express themselves fully through handicraft of one kind or another, and the idea that such modes of self-expression are inferior to others must be abandoned. Unless, however, there is a new “ spirit ” in rural education from the ages of 11 to 15, there will be no progress, and it is the duty and privilege of agricultural education to supply inspiration as well as information.

The Rural Central Schools will in all cases be but a stepping stone to something else. The majority of the pupils will doubtless proceed to farming, or other work in the towns or in the country. Those who go to the towns will, by virtue of their training, be at least as well qualified to succeed in an industrial vocation as their fellow-workers from the city schools. They should retain throughout their lives the stabilizing influence, the wider outlook and the endless interests which result from an early acquaintance with nature and country life. Similarly, just as a boy who has learned to swim can never lose the art, so lads who have been *taught* to be “ handy ” in the country will bring to their work in the town an all-round proficiency

in handicraft that will stand them in good stead. Employment they are sure to obtain, and leisure hours, in after years, can be devoted in part to gardens or allotments or to the full enjoyment of return visits to the country. To maintain and extend these rural interests is certainly one of the functions of agricultural education, and it is for this reason that in Hertfordshire much time is given to the encouragement (by lectures, demonstrations and organized visits to the Institute) of Allotment Societies, Horticultural Societies, Poultry Clubs, etc. Other efforts to promote mutual understanding between town and country have included conferences with the Medical Profession, with Sanitary Inspectors, with Secondary School Teachers, with senior children from urban schools, and so on. But these, at the best, are fragmentary efforts, and undoubtedly their extension on organized lines presents a wide, largely unexplored field of valuable services, which agricultural education has still to enter. The ignorance that prevails in our urban centres on the source of food supplies and on the æsthetic and cultural side of country life is often deplorable and cannot but be harmful to our national well-being.

Perhaps, however, the greatest tragedy in rural education lies in cutting the majority of future land workers completely adrift, at present for two years, later perhaps for only one, from all contact with rural education. The result is two-fold ; on the one hand the progressive and well-equipped mentally, or those with means, are simply driven into the towns for further advanced education, and on the other hand, those who are left are ill-equipped to give a good account of themselves in the country. In the towns the educational ladder is complete, so complete that it acts as a magnet drawing the life blood out of the country. In the country there is no ladder, merely a few steps until the age of 14 is reached, then a chasm which few can bridge. There is no alternative except the establishment of Rural Secondary Schools, if the rural districts are to receive educational justice. Let those who wish and are able to do so proceed to the town for further education, but let no one do so because there is no alternative. As to what these Rural Secondary Schools should stand for from the point of view of education, it is perhaps sufficient to emphasize two points. First of all, the quality of the work done by specially selected and highly qualified staffs should cause them to become recognized as providing an advanced education of at least as high an order as that in any urban school. Secondly, their curriculum should be as different from that of the urban schools

as that of the Rural Central Schools is from similar schools in the cities. There is abundant material, historical, geographical, mathematical, biological, etc., to offer the most liberal education. On the practical side, the work begun in the Rural Central School could be extended, with additional opportunities for engineering and applied handicrafts. There need be no lack of scope, and nothing should be allowed to stand in the way of the necessary effort to secure adequate support to bring this result to full achievement. Such, in outline, is a means of bridging effectively the great gap in our rural education ; of bringing the Farm Institute in contact with the schools ; and the Colleges and Universities in touch with the best source for providing teachers for this more advanced Education.

The Rural Secondary Schools can perform two further very important functions. The majority of young pupils may still be unable to take advantage of even this new type of secondary education. May not the Rural Secondary Schools take at least a number of them under their wing for a year or two (Y in diagram) ? One day per week during the winter months devoted to rural, biological studies and to skilled handwork instruction, could be made an enormously powerful lever towards promoting still further a genuine interest in rural environment, as well as efficiency in work. How foolish to restrict the application of physical training to games and sport when success in both sport and work depends on acquiring the necessary knowledge and skill early in life. Unless most farm operations are learned before the age of 17 or 18, there is little prospect of any high degree of efficiency in after life. On the other hand, active healthy lads can very quickly become skilful in any operation if it is taught by right methods. The specialized skill which exists in certain districts could then be transferred or grafted on to other districts with a consequent levelling up of the quality of farm labour. If, however, Education has no provision for such progress, the Rural Secondary School is unnecessary, and the school leaving age might as well remain at 14 or even lower. Progress must, however, take place, since rural England cries out for men so educated as to make them fit for, and worthy of, their environment and proud of their handicrafts. The suggestions given above provide for a complete rural educational ladder :—

Rural Central School to Rural Secondary School, to Farm Institute ; thence to the Farm or to College and University,

or

**Rural Central School to Rural Secondary School Influence,
and thence to the Farm Institute and to the Farm.**

One other cycle is included in the Diagram, namely, the absorption of young men from the towns who are determined to find a career in the country. There are many such, and often they represent, not the dunderheads, but the stamp of men who can bring new life and energy into agriculture. At present these lads drift into the country, and often experience acute hardships and an accentuation of their difficulties. But with the reorganization of rural education they would fit naturally into the educational system, either in the Rural Central School, the Rural Secondary Schools, or under the influence of the latter; and they could come naturally along to the Farm Institute, after having absorbed something of the rural atmosphere and acquiring the necessary preliminary training and experience.

Lastly, there is something required to link up those who have gone through their course of instruction at the Farm Institute. It is a short-sighted policy to turn out trained men and then to forget about them. Those who have gone through the new process of rural education from the elementary schools to the Farm Institute must constitute the great hope for the future. They must represent the spirit of progress, the real leaven for the whole industry. It is not enough to form an Old Students' Association, rather let them form a Young Countrymen's Union or a Rural Progress Association on national lines. This Union or Association would have interests which extend from the Rural Central Schools, whence will come the new members, to the promotion of collective efficiency in Rural England.

The Farm Institute.—At present the Farm Institute is an isolated stronghold in the scheme of agricultural education. It has no continuous communications with its "base," i.e., the schools, rural or urban. The majority of the supplies are lost in the educational gap which exists in the educational system between the ages of 14 and 16. Those which do come through vary enormously in quality. Some are obtained from the biggest sources of supply, namely, the children who leave school at 14 and are enabled by scholarship or otherwise to enrol for further training after the lapse of several years. Many receive Ministry of Agriculture Scholarships for the sons and daughters of agricultural workmen and others, and no praise can be too high for this scheme. Others are from secondary schools, and a

few from public schools. The individuals who comprise the 30 or 40 students in any one year are usually between 16 and 25 years of age, and all have been so educated as to make it necessary to begin every branch of agricultural teaching from the very beginning, while some have manual skill in certain directions and others have no developed skill at all. They represent as mixed and varied a class as ever came before any teacher. Yet, in spite of all these disabilities, the progress made is quite remarkable. No teacher, for example, can have a greater reward than to see the labourers' sons gradually improve in speech, writing and outlook, until through genuine keenness and ability, they gain the distinction of becoming the best students of their year. Yet these results are by no means unusual.

How different all this may be when effective co-ordinations are established, and when each Institute receives students from its own county, in a regular stream, from the proper sources, at the right age, and with a preliminary basis of education which qualifies them to specialize in the subjects with which the Farm Institutes are specially fitted to deal. These aspects of the work of Farm Institutes are indeed fascinating, for they serve to illustrate the weakness of these "strongholds" in our present system of agricultural education. It is necessary, however, to pass on to the consideration of other activities which involve contact with schools and school teachers, with farmers, smallholders and those engaged in all forms of agriculture and horticulture, with land workers, with Colleges and Research Stations, and with the public. It is not possible to deal fully in this essay with all of these connexions, but the following summary is an attempt to convey some of the essentials :—

Residential School.—As a residential school the Institute is definitely concerned with vocational training, although there is no need to neglect the wider cultural outlook. At "Oaklands," the essential laboratory for this training consists of commercial units. These are the farm (230 acres), the fruit plantations and horticultural department (14 acres), the commercial glasshouses (1½ acres), and the poultry department (9 acres). The first object of each of these departments is to demonstrate to students how to make them a commercial success, and there can be no better laboratory for students or staff, as teaching must be done by example through actual experience, as well as by precept. The second object is to pro-

vide the opportunity for instruction by recorded contrasts, a system which can be best explained by examples, as follow :—

Educational Contrasts at "Oaklands."

			A	with	B
Cows	Twice a day milking	Three times a day milking.			
Baby Beef	Dairy Bred Steers	Beef Bred Steers.			
Grass land	Intensive Rotational Grazing, 7 plots of 5 acres receiving nitrogen.	Rotational Grazing, 2 plots of 5 acres receiving no nitrogen.			
Grass Seed Mixtures .	Indigenous Strains	Commercial Strains.			
Lucerne	Inoculated	Not inoculated.			
Pigs	Middle White Cross	Large White Cross.			
Sheep	Suffolk Cross	Southdown Cross.			

The above are a few of the farm contrasts. Each one is carried on without interruption for several years, and the accumulated records are analysed for the purpose of reaching conclusions which shall be of real value to students and farmers. The interest for all concerned is continuous, as there are no scientific perplexities or reservations, and the purpose of the contrast is clear and of practical value. Similarly, in the fruit orchards, valuable and frequently conclusive contrasts are regularly being worked out, in the details of which students actively share, *e.g.*, spraying, pruning, manuring and the use of root stocks. Poultry-keeping has not developed quite so far, though the need is even more urgent; while the glasshouse scheme is not yet fully in operation. These and many other records would, however, have greater significance and value if they formed part of an organized recording scheme, done in co-operation with other Institutions. A beginning, small but hopeful, has been made in this direction with the provincial centre at Cambridge.

Apart from the use of the commercial departments in these ways, providing work in the classroom as well as out of doors, the main subjects which have to be taught at a Farm Institute are applied science, engineering, economics, farm management, marketing and applied handicraft. With the introduction of missing links in the chain of agricultural education we shall

be able to deal with all such subjects much more fully than is now possible.

County Work.—A Farm Institute does not, however, exist solely, or mainly, as a residential school. Its sphere of influence extends to the boundaries of the County in which it is situated. The purely educational work in connexion with schools has already been referred to, and need not be elaborated further. Before dealing, however, with the work which is actually done in the County it is appropriate to refer briefly to three activities which are centralized at the Institute, viz., the County Egg Laying Trials; the Butter Fat Testing Scheme; and Visits to the Institute. The first serves a most excellent purpose, although one is inclined to think that these poultry plants could be made to serve a double purpose if two counties combined so that in alternate biennial periods they could be used for laying trials and for nutrition demonstrations. There is nothing more urgently required in the poultry world than ocular demonstrations of the results of good and, the more usual, defective feeding. The opportunity exists to give these demonstrations with untold financial gain to poultry farmers, if only agricultural education could practise what it preaches about co-operation.

In connexion with butter fat testing, over 1,000 samples are analysed at "Oaklands" per month. The Scheme is wholly admirable, if one could be sure that the results entered into breeding operations, as they should. To do certain work and to issue statistics to individuals is merely a means to an end. In the case of butter fat tests, milk recording, etc., the tendency is to be content with the "means" and to fail to apply the results. "Not applied" is more the rule than the exception with statistics that ought to be of great value in the breeding of dairy stock.

Visits to "Oaklands" during the spring and summer by individuals and organized parties have now become an extremely valuable feature of the educational work. The opinion is freely expressed that these visits and the long discussions that take place in the field and stockyards constitute one of the most valuable aspects of our adult education. A farmer, a stockman, a fruit grower, or a poultry keeper can be influenced far more effectively through his eye than by much verbal description only. More than 1,200 visitors, in organized parties, have been shown round this year, and these and other such visits have probably done as much as anything else to bring agricultural education into favour in Hertfordshire. A

farm well run, and orchards properly cultivated, arouse interest ; the contrasts referred to above and the subsequent discussions together ensure enduring impressions.

The actual County work includes lectures, advisory visits, field demonstrations, competitions in " manual processes," etc., all excellent in themselves and doubtless very useful, but the root of things lies with the young, with a reformed rural education, stimulated and inspired by extended agricultural education activities. Apart from that, the weakness in County work is none other than this, that the things that would most benefit the farmer and the nation are often incapable of individual application. It is the collective sides that are weak and there are three urgent needs :—

- (a) Labour-saving methods. These involve better implements and machinery, more efficient skilled workers and better management.
- (b) Marketing reform. The possibilities of organized marketing have too long been neglected by agricultural education, though now there is the opportunity to encourage, if not to lead, in this direction.
- (c) Live stock improvement. This is not merely a question of the registration of bulls, but a matter for all round collective action in which agricultural education has not so far provided many data or given sufficient demonstration.

These are three big agricultural problems which demand collective attention.

Towards the reduction of labour costs there is no lack of inventive genius within the industry. Unfortunately, the inventive spirit is handicapped by isolation, lack of facilities, capital and prospect of reward. To meet this handicap it should not be impossible to devise a scheme which would enable latent talent to find effective expression. Again, organized marketing is a primary necessity before the full benefits of agricultural education can be attained. At present the gamble of the market is ever present in the farmer's mind, whereas, under a better system, production would receive more attention and the quality of produce would bear a closer relationship to price. Payment on ascertained quality should be an education in itself. On the subject of live stock improvement it is impossible to overstress the urgency of the need for a general raising of the average. There is no economy so capable of widespread application as that which could be effected by the improvement of our live stock.

In these directions agricultural education and agricultural research, in conjunction with the major authorities, have unlimited opportunity for rendering the most valuable services to agriculture. A concentrated co-operative effort, utilizing

to the utmost both science and the scientific method, should bring a speedy harvest of good results.

Research and Agricultural Education.—What has “research” contributed towards the relief of the present agricultural depression? During eight years of the management of the commercial departments at “Oaklands” what results from the research stations have been incorporated into our practice and what unsolved difficulties have been encountered?

We may give the following examples:—

- (a) Lucerne inoculation has affected some 5 acres of our land twice in eight years.
- (b) Fruit tree stocks have profoundly improved the prospects of our fruit orchards.
- (c) Indigenous strains of grasses and clovers are opening up new possibilities with regard to temporary and permanent pastures.
- (d) In addition, from industrial sources, there appear to be limited possibilities in the Eastern and Home Counties with regard to the use of nitrogen on grass land.
- (e) The fruit grower has enormously gained by the introduction of tar distillate washes.

Such is the complete story from that point of view. Now what have been our difficulties? From the farm we give the following examples:—

Labour Costs—

- (1) There is a most urgent need for labour-saving devices. If illustrations were required they might be given in plenty, but it must suffice to mention the muscular energy that is expended year after year in the man-handling of dung and roots. In an age of mechanical progress it is not creditable that agriculture should suffer neglect in these and such respects.
- (2) Skilled labour is becoming scarce, and there are insufficient and inadequate training facilities to fit young men to handle even the existing mechanism in use on farms.

Stock—

- (1) Wastage of dairy cows, or disposals and replacements in the dairy herd, has been found over a period of seven years to cost not less than 1½d. per gallon of all milk produced. In spite of every precaution, we continue to incur losses through abortion, sterility, and other diseases.
- (2) Poor Milkers. A great loss in the dairy herd results from breeding heifers which turn out to be poor milkers. Here certainly is a nice problem, as this unfavourable result is obtained in spite of the use of dairy shorthorn bulls specially selected on account of their milk pedigree. One is forced to ask the question: “Is the principle of using a proven sire sound, or is it unsound?” That it is sound seems to be proved by the historical examples set by our own famous breeders in the past and by modern evidence from the Continent and the United States. It follows that live stock improvement schemes which neglect this point of view are incomplete, and how far this is so in this country is apparent, when it is said that statistical evidence of the value of the proven sire is only obtainable from foreign sources. As the scientist has no alternative to the use of the proven sire, and as every known authority agrees that the use of such

sires is sound in principle and in practice, it is surely time to do two things: (a) to turn accumulated data to practical use, and (b) to organize large scale demonstrations on the use of these proven sires.

Cost of Rearing Heifers

It has cost at least £30 per beast at "Oaklands" to rear a heifer until she comes into the dairy. This raises a question of considerable economic importance to the milk producer in the Eastern Counties. One of the stated advantages of milk recording is, that it enables the farmer to rear heifer calves out of good milking cows: but if the heifer costs well above her market value to rear, and her milking qualities when reared are in doubt, a substantial loss may be involved. For the milk producers in certain areas to discontinue rearing may be one solution, but it is a poor one compared with the "collective" possibilities.

Pigs

The best breed for bacon? Why argue this point, when by simple well-organized co-operative tests on educational farms and elsewhere there should be no difficulty in at least eliminating most of the undesirables from the discussion.

Sheep

In Hertfordshire, and doubtless in other counties, no fewer than 14 breeds of grassland sheep are used. Nearly all these ewes are crossed with one or other of seven breeds of rams, so that there is the possibility of finding 98 differently bred grassland sheep in one County. That all are equally good is disproved by our own tests with three of the breeds, and the differences are considerable. Again, there seems a need for co-operative recording, as a simple way of obtaining answers to the questions the farmer asks.

Cereals

Several difficulties arise in the growing of cereals. The first is in the purchase of good seed, true to type and at a reasonable price. The second is the confusion created by the presentation of so-called new varieties which are really not new at all. Third is the lack of strong strawed varieties which will stand up to intensive manuring. Fourth is lack of efficient means for the control of insect pests such as wireworm, etc.

Special mention must also be made of the "vicious circle" whereby a research worker after years of painstaking work provides the community with a new and improved variety, and then spends further years in identifying "new" varieties as identical with his own creation!

The above examples of what is required might be multiplied indefinitely from farm, garden and other departments, but sufficient has been said to enable certain conclusions to be drawn.

(1) Research is required on labour-saving devices, on the psychological aspect of farm operations, on the selection and invention of proper tools and implements, and generally on increasing the "output per man" employed in agriculture.

(2) Live-stock improvement offers tremendous opportunities for organized recording, large scale demonstration and fundamental research.

(3) Well organized co-operative recording and testing are

needed in conjunction with research work, and with the possible practical applications of new discoveries.

(4) A plea is made for a fuller recognition of the strategically strong position held by the Farm Institutes as intermediaries between the Research Stations and the farmer.

(5) It is undesirable to overestimate the importance of manures and manuring while such vital matters as cultivations, live stock improvement and labour-saving devices require greater investigation.

Summary.—(1) The above suggestions and conclusions have been inspired by the idea that the purpose of agricultural education is at least threefold :—

(a) To stimulate in urban as well as rural districts a genuine love of the country-side ;

(b) To secure individual and collective efficiency in all rural pursuits ; and

(c) To promote mutual understanding between town and country.

(2) To fulfil such a purpose means traversing a wide field. A variety of instances of the scope of agricultural education are discussed. Included in these is the need for recognition of the partnership between industry and agriculture.

(3) The fountain-head from which spring the living waters of progress for rural England are the schools—Junior, Central, and Secondary. To influence and inspire that source is the first and most important function of agricultural education.

(4) It is suggested that a reconstruction of rural education is urgently needed, in order that the present and future generations of workers may be well equipped for the cultural enjoyment of their environment, and have power and opportunity to take pride in their individual contributions to a fundamental national industry in which they must be vitally concerned.

(5) Rural Central Schools and Rural Secondary Schools appear to be indispensable, for together they should be the means of giving body and soul to rural education, but their “ mould ” must be very different from that of similar schools in the towns.

(6) These schools are a necessary preliminary for the fullest development of the Farm Institutes, the special activities of which are discussed.

(7) The Farm Institute should provide inspiration and information for rural and urban school teachers, to all engaged in rural occupations, to research workers, and to the public generally. It is concerned with technical and vocational train-

ing and with individual and collective efficiency in the industry. If, indeed, such functions fall to the lot of the Farm Institute it may properly be described as a "stronghold" of educational endeavour.

(8) Agricultural education must receive aid from and become co-ordinated with the Research Stations. A plea is, however, submitted for more collective, co-ordinated investigations on subjects of immediate practical value, of which labour-saving devices, marketing and live stock improvement are major examples, though there are very many other minor problems. Some examples of these have been given.

One word in conclusion. It is often said that the backbone of a nation is a virile, prosperous, efficient, and contented peasantry, but it must be added that the backbone of the peasantry is character and education. This Essay will not have been in vain if it helps in any way to arrest the rot which is taking place in so many of our rural districts. The whole of my criticism is meant to be constructive. I trust that the motive is clear, though the words may be weak. "A virile, prosperous, efficient, and contented peasantry," "Character and education." The purpose of agricultural education is so wide and comprehensive that there is no lack of scope for earnest and serious endeavour.

* * * * * *

PIG BREEDING : TRADE REQUIREMENTS

THE following memorandum by Mr. A. E. Marsh and other members of the Pig Industry Council deals with (1) the type of pig carcass required by the distributive trade and (2) the breeds and/or crosses of pigs best suited to produce such type.

To :—

The Secretary,

The Pig Industry Council,

10 Whitehall Place, London, S.W. 1.

We, the undersigned, members of the Pig Industry Council, in accordance with the desire of the Breeding Committee of the Council to obtain evidence as to the type of carcass required by the various classes of the distributive trade, and as to the experience of distributors concerning the breeds and/or crosses best suited to produce such type of carcasses, herewith submit in our individual and representative capacity our unanimous opinion on the questions raised.

Type of Carcass.—The type, conformation and general quality of carcasses suited to the requirements of the pork, bacon and ham trades are uniform.

The type of carcass which meets the requirements of Wiltshire side and Midland curers also meets those of the pork trade and vice versa. There is no need to introduce further complications into pig production by requiring farmers to produce two distinct types of pigs accordingly as they prefer to supply the pork or the bacon market. The farmer producing the type of carcass in greatest demand by the pork trade can, if that trade does not appear to be remunerative, grow his pigs on to bacon weights and provide the type of carcass required by the curing industry.

In so far as any variations exist in carcasses demanded by those three sections of the industry, such variations are, given proper feeding, variations only of weight and not of type. In this connexion the basis of weight classification as scheduled in the Ministry of Agriculture's Report on the Marketing of Pigs* is acceptable to the distributive trades.

Carcasses for the pork, bacon and ham trade should conform to the following specification:—

The carcass must be that of a properly fed, castrated male or virgin female pig, the predominating colour being white. The middle portion from the first rib to the aitch bone must be long. The fore-end must be light with a light head, neck and collar, and the gammon end well developed. The ribs must be well sprung, that is to say they must not slope rapidly from the back-bone but clearly indicate where the back leaves off and the side begins. The line of the back must be slightly arched from head to tail and not dished or humped over the shoulder. The neck must be of medium length and devoid of crest. The shoulders must be smooth, slightly rounded from side to side over the top and very compact. The back fat should be even, without pronounced thickening over the shoulder and it should taper slightly from the shoulder to the gammon, and should fall within the following measurements at the shoulder:—

<i>Approximate dead weight of carcass</i>			<i>Depth of back fat</i>
60-100 lb.	..	..	Up to $\frac{1}{2}$ inch.
100-130 "	..	..	$\frac{1}{2}$ inch to $\frac{3}{4}$ inch
130-160 "	..	..	$\frac{3}{4}$ " $1\frac{1}{2}$ "
160-180 "	..	..	$1\frac{1}{2}$ " $1\frac{3}{4}$ "
180-210 "	..	..	$1\frac{3}{4}$ " 2 "

The underline must be straight and thick throughout its whole length, entirely free from flabbiness or distension of the flank. Thick lines or streaks of fat should be absent from the visible portion of the lean and indications of leanness must be visible between the ribs.

The shanks must be short, bone fine and the fore hock and ham free from wrinkles. The flesh must be carried well round the bone leaving no bareness inside the thigh, and well down to the knee and hock joints.

The vertebræ must be of a flesh-pinky colour and flinty in texture. The proportion of lean to fat must be good. The fat must be perfectly white and firm to the touch ; when pressed with the thumb, an indentation should be formed which remains visible for a few minutes after pressure has been removed.

The texture of the lean must be fine grained and not rough or fibrous, there must be no excess of internal fat—the kidneys should have a thin covering of fat. The rind must be thin, flesh-coloured, perfectly smooth, pliable and free from deeply-rooted bristles, and must be devoid of any skin pigmentation. There must be no indication of black bristle and no sign of seedy cut.

Carcasses conforming to this specification produce a high proportion of the best cuts whether as pork, bacon or hams, and are the product of selective breeding and proper feeding.

Breeding.—*The Boar.*—The question of breeding for trade requirements is the pivotal factor in any action which may be taken to improve and therefore increase pig production in this country. The production of a standard type of carcass depends in the first place upon the adoption by producers of a well-conceived breeding policy, and secondly on proper feeding. In this connexion the predominance of the pure-bred Large White boar as the sire of the best commercial stock in this country and those supplying the home market is unquestioned.

There is no evidence either at home or abroad to show that boars of any other breed have been so widely adopted for the purpose of producing commercial pigs to suit the requirements of the English bacon and pork markets and of providing producers with hardy, quickly maturing stock.

It is important, in this connexion, however, to stress the necessity of adherence to Large White boars of the correct type and of pronounced character.

The Large White boar should have a head showing masculinity but free from coarseness, should be light in the shoulder, long in the back, which should be slightly arched from head to tail, and with a full deep loin and a long well-developed rump. The ribs should be well sprung, then should drop fairly straightly, giving a smooth even side blending with the shoulder and hindquarters. The hams should be smooth and tapering, without any excessive bulging. The underline must be straight and the hair fine and silky. Mane bristles must be absent. Short, straight legs, with strong clean-cut bone, are essential, and the pasterns must be short and upright.

The general impression created by the view of the pig should be a well ribbed up pig with good length, but at the

same time smooth and compact, straight lines top and bottom, with light shoulders and good deep hams, standing on short legs and in every respect full of quality.

In order to improve the general standard of pigs to meet the requirements of the pork, bacon and ham trades it is recommended that producers should be advised to utilize pure-bred Large White boars of the type specified.

The Sow.—In arriving at a preference for sows of certain breeds as dams of commercial stock, due consideration has been given to the needs and practice of pig producers in all parts of the country, and it is contended that there is no important divergence of opinion between the great majority of pig producers in the country and the distributive trades on the question of the merits of certain breeds of sows as being most suitable for their respective purposes. The breeds of sows favoured by the trade form in the aggregate the greatest proportion of the breeding stock of England and Wales. Sows, however, of these breeds are of diverse types and, moreover, are too frequently crossed with boars other than those of the Large White breed, or when crossed with Large Whites the boars are not always of the type desired. In other words, there is but little division of opinion between the great body of pig producers on the one hand, and the trade on the other so far as breed preferences are concerned ; the weakness of the existing situation is that the breeds concerned are not of the uniform type and are not always crossed with a Large White boar.

The sows preferred by the trade and the majority of producers are of the following breeds: Berkshire, Large Black, Middle White, *Welsh, and Wessex.

No order of merit is suggested, as it is desired that within the limits specified every latitude should be given to producers to combine in an effort to raise the general standard of production.

Sows of the above breeds should possess the following characteristics: quiet disposition, symmetry of form, good carriage and freedom of movement, light shoulders and plump hams, straight short legs set well apart, strong pasterns, causing them to stand up well on their toes, and with sound

* The Welsh Breed was not included in previous recommendations of the Pork Butchers and Wiltshire Side Curers' Organization, partly owing to the paucity of the breed and partly to the fact that its identity was threatened when it became merged with another breed. The Midland curers have consistently maintained a preference for the Welsh Breed.

udders, having an even number of well-developed drills. The drills should commence as near to the foreleg as possible, and should be disposed at equal distances along the entire length of the udder ; they should be from twelve to sixteen in number. Particular attention should be paid to the condition of the udder. A sow having a hard lump or lumps in this region, or possessing any blind drills, should not be selected for breeding purposes.

In order that the boars and sows recommended should conform to a uniform type it is considered that breed societies should endeavour to ensure that judging should take place on more consistent lines, and that greater attention should be paid to the commercial characteristics of pedigree stock. In this connexion the system of recording adopted by a few societies is commended, and efforts should be made to expand the scope of recording in order that the carcass values of breeding stock can be better appreciated than at present, when no attention is paid to this highly important aspect of the industry.

Further, it is considered that the Pig Industry Council should recommend to the Ministry of Agriculture that a few breeding centres and testing stations be established, with the object of establishing reservoirs of tested breeding animals of the breeds recommended, in order that producers may have the opportunity of producing a higher standard of commercial animal of uniform type.

Finally, the foregoing is not submitted as a policy of perfection ; it is realized that uniformity of type could be more quickly and efficiently achieved if two breeds only were involved in the process. Nevertheless, taking into consideration the existing conditions of pig production in this country, if the policy outlined herewith were adopted it is believed that in a comparatively short time a considerable improvement in the general level of production would take place which would undoubtedly react to the advantage of both producers and distributors.

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SOME RECENT INVESTIGATIONS INTO SUGAR BEET PROBLEMS—I

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WITH the increasing demand for information by growers and others interested in home-grown sugar production, various investigations became necessary to provide the required data, and the experimental work discussed in this paper was undertaken at Bristol, Cambridge and Oxford, primarily with the object of solving local problems, but also to deal with inquiries on various points connected with the industry. The items may be classified as follows :—

(A) Storage of Sugar Beet ; (B) Methods of Analysis ;
(C) Rate of Production of Sugar during the Growing Period.

Item (A), "Storage of Sugar Beet," is dealt with in the following article ; Item (B), "Methods of Analysis," will follow in next month's (February) issue ; and Item (C), "Rate of Production of Sugar during the Growing Period," will form the concluding article to appear in the March, 1930, issue of the JOURNAL.

(A) THE STORAGE OF BEET

These investigations were undertaken at the request of the Ministry as an attempt to ascertain the desirability of clamping some part of the crop and so lengthening the factory campaign, which normally extends from October to early in January. Such a procedure, if commercially satisfactory, would enable the grower to proceed at an earlier date with winter cultivations, and the beets could be removed from the ground when at their maximum sugar content. The series of clamping experiments were commenced in the season 1927-28 and continued during 1928-29, as the results obtained from the first year's work were such as to demand further experimental data, since it appeared that the abnormal season had adversely affected the keeping qualities of the beets.

1927-1928 Experiments.—When the first series was undertaken the details of the work were left to the individual investigators, as various unknown factors had to be faced. The actual experimental details differed slightly at each centre, and were of a fundamental nature in order to determine the relative merits of various methods of storage. Strict replication of experimental details between the workers

concerned was not attempted. The methods employed in storing the beet were :—

(1) The ordinary clamp, as used for mangolds, *i.e.*, with a 4-ft. triangular section and containing about one ton of roots per yard run. These clamps were covered with straw and earthed over. It may be noted that some of the factories object to the use of straw, as it may adhere to the beets and be carried into the flumes and elevating apparatus at the factory; but with ordinary care there seems little danger of long wheat straw reaching the factory at all.

(2) A temporary clamp under a Dutch barn with no other protection than that afforded by the barn roof.

(3) A temporary clamp loosely covered with the beet tops and some soil. This type of clamp is not weather-proof.

In order to obtain a representative sample of the beets in the clamp two methods were adopted.

(a) Several lots, each of 50 clean, dry, weighed beets, were taken and placed in open-mesh bags. These were evenly distributed through the whole length of the clamp during its construction and a maximum-minimum thermometer was inserted at the same time.

(b) Several lots, each of 50 clean, dry, weighed beets, were taken and each individual "root" was labelled with a coloured tape. These were distributed throughout the clamp so that a fair proportion would be susceptible to local variations in and around the clamp.

At one centre, two sets of samples—an early and a late variety—were used. At another centre, crowned and uncrowned beet were employed as duplicate representative samples. The samples were removed in every case at fortnightly intervals and the necessary analysis made with the minimum of delay. The results obtained are set out in Tables I-IV.

1928-1929 Experiments.—After consideration of the data obtained in the previous year it was decided that a further series of experiments should be undertaken with strict replication at all the centres. The methods adopted were as follows :—

Six lots, each of 50 beets, were selected as in the previous year and placed in similar clamps of the type used for mangolds, but each set of 50 beets was enclosed in a loosely woven net, instead of in bags. This was to ensure free circulation of air throughout the length of the clamp. The clamps were 10 yards long, and the nets were distributed evenly along the entire length, so that each sample was separated by more than a yard from its neighbours.

At one centre, the labelling of individual beets for even distribution throughout the clamp was continued. At another centre, the same variety (*Kleinwanzleben*), grown on a soil of fen type, was duplicated with the ordinary experiments.

Laboratory procedure was practically identical at all centres, and each sample was subjected to the following determinations:—

(1) Loss of weight of the entire sample during storage. (2) Dry matter content of the pulp. (3) Percentage of sugar (sucrose)

TABLE I.—BRISTOL. DATA OBTAINED FROM BEETS IN CLAMP. 1927-1928

Bag No.	Date of clamping	Date removed from clamp	Period stored	Weight at clamping	Weight at laboratory after removing from clamp	Weight at laboratory after removing from clamp as percentage of weight at clamping	Dry matter at time of removing from clamp	Dry matter as percentage of original dry matter	Sucrose at time of removal	Sucrose as percentage of sucrose in original beets
			Days	lb. (1) <i>Early</i>	lb. <i>Maturing Beet</i>	Per cent. <i>Beet</i>	Per cent.	Per cent.	Per cent.	Per cent.
X	Nov. 8	Nov. 8	—	63	60 (a)	95.2	26.86	100.0	17.73	100.0
3	" 8	" 23	15	70	69	98.6	25.00	92.6	17.71	100.0
1	" 8	Dec. 6	28	64	60	93.8	25.10	93.3	17.26	97.8
2	" 8	Jan. 3	56	62	59	95.2	25.43	94.4	15.55	88.2
7	" 8	" 10	63	64.5	63.5	98.4	25.10	93.3	17.00	96.0
8	" 8	" 18	71	65	62.5	96.1	23.20	86.3	16.00	90.0
5	" 8	Feb. 2	86	62.5	64	102.4	23.92	90.0	17.22(b)	97.2(b)
4	" 8	" 18	102	64.5	65	100.8	24.26	90.4	16.06	90.9(b)
6	" 8	March 1	114	61.5	58	94.3	24.85	92.6	16.65(b)	94.3(b)
X	Dec. 1	Dec. 1	—	(2) <i>Late</i>	<i>Maturing Beet</i>	Per cent. <i>Beet</i>	Per cent.	Per cent.	Per cent.	Per cent.
14	" 1	Dec. 1	33	56	56	100.0	23.70	100.0	15.00	100.0
12	" 1	Jan. 3	40	57.5	52.5	91.3	22.91	96.6	13.33	53.7
11	" 1	" 10	48	60.5	59	97.5	22.20	93.7	13.90	92.7
17	" 1	" 18	63	66.5	65.5	98.5	21.10	89.0	13.50	90.0
13	" 1	Feb. 2	79	55	54	98.2	20.00	84.4	9.46(b)	63.0(b)
16	" 1	" 18	91	60	60	100.0	20.66	87.2	15.70(b)	104.7(b)
	" 1	March 1		72	68.5	95.1	20.72	87.5	15.70(b)	104.7(b)

(a) Weight lost in transporting this sample.

(b) Beets badly frosted—results probably not reliable.

TABLE II.—CAMBRIDGE. DATA OBTAINED FROM CROWNED BEET IN 1927-1928

Sample bag	Weight November 9, 1927	Weight after storage	Date storage ended	Percentage of dry matter	Percentage of sugar	Sugar in 100lb. beet stored
	lb.	lb.		Per cent.	Per cent.	lb.
1	Control	Control	Dry in covered	sheds.		
14	52	50.5	November 10	25.00	17.5	17.50
16	49.5	47	" 24	24.85	17.5	17.00
18	46.5	43	December 7	25.30	17.6	16.71
20	46	43.5	" 21	25.45	18.0	16.64
22	42	38	January 4	26.10	17.7	16.74
24	59.5	53	" 18	26.45	18.3	16.56
			February 1	26.25	17.5	15.59
1	Control	Control	<i>Stored wet in clamp</i>			
15	47.5	46.5	November 10	25.00	17.5	17.50
17	48	48	" 24	25.55	17.5	17.13
19	48.5	46.5	December 7	25.10	17.6	17.60
21	46	46	" 21	24.57	17.5	16.77
23	49.5	49.5	January 4	24.84	17.1	17.10
25	54.5	54.5	" 18	23.90	16.8	16.80
			February 1	24.05	15.8	15.80

TABLE III.—CAMBRIDGE. DATA OBTAINED FROM UNCROWNED BEET (LEAVES ONLY REMOVED), 1927-28

Bag	Weight November 9, 1927	Date taken from storage	Weight after storage	Weight crowned	Percentage of dry matter	Percentage of sugar
	lb.		lb.	lb.	Per cent.	Per cent.
1	50.5	November 10	<i>dry</i> in covered 50.5	sheds 42	25.00	17.5
2	52	" 24	50	42	24.85	17.9
4	54.5	December 7	52.5	41.5	24.85	17.5
6	56.5	" 21	52	41	25.29	17.8
8	50	January 4	46.75	38	25.89	17.7
10	54.5	" 18	50	40	25.00	17.7
12	54.5	February 1	49.5	40.5	24.55	17.9
			<i>red wet</i> in clamp			
1	50.5	November 10	50.5	42	25.00	17.5
3	57.5	" 24	56.5	46.5	25.00	17.1
5	53.5	December 7	53	40	25.10	17.9
7	59	" 21	54	45	24.30	17.2
9	50.5	January 4	51	42	24.64	16.5
11	54.5	" 18	55	43	23.85	16.5
13	55.5	February 1	57	48	23.95	16.4

TABLE IV.—OXFORD. DATA OBTAINED DURING 1927-1928

Series	Date	No.	Wt. (in)	Wt. (out)	Wt. Loss	P't'ge loss wt.	P't'ge suc- rose	Condition when extracted
Long period clump (1) 7 lots of 50 beet in bags.	Feb. 7	1	oz.	oz.	oz.	%	%	Good.
	" 21	2	845	839	7	0.86	15.1	"
	Mar. 6	3	770	754	16	2.1	15.4	"
	" 20	4	822	803	19	2.3	14.7	Growing and weeping
	April 3	5	669	644	25	3.6	14.8	"
	" 17	6	810	767	43	5.3	13.3	"
	May 1	7	673	637	36	5.05	13.3	Bad.
Long period clump (2) 7 lots of 50 beet individually labelled and put in loosely.	Feb. 7	1	713	706	7	0.9	15.1	Good.
	" 21	2	760	741	19	2.5	15.1	"
	Mar. 6	3	620	597	23	3.7	15.6	"
	" 20	4	614	581	33	5.3	15.3	Growing and weeping
	April 3	5	716	682	34	5.4	14.3	"
	" 17	6	648	604	44	6.8	14.3	"
	May 1	7	785	681	104	13.3	12.2	Bad.
Short period clump (1) 7 lots of 50 beet in bags.	Feb. 7	1	728	726	2	0.26	15.4	Good.
	" 14	2	667	660	7	1.5	15.1	"
	" 21	3	687	678	9	1.4	14.6	"
	" 28	4	578	563	15	2.6	14.5	Fair.
	Mar. 6	5	818	880	18	2.2	14.4	"
	" 13	6	656	640	16	2.5	14.3	Weeping.
	" 20	7	767	749	18	2.3	14.6	"
Short period clump (2) 7 lots of 50 beet individually labelled and put in loosely.	Feb. 7	1	709	707	2	0.28	15.3	Good.
	" 14	2	810	799	11	1.3	15.1	"
	" 21	3	812	799	13	1.6	14.1	"
	" 28	4	934	922	16	1.7	14.5	Fair.
	Mar. 6	5	833	799	34	4.0	14.5	"
	" 13	6	926	902	24	2.5	14.2	Weeping.
	" 20	7	832	810	22	1.9	14.1	"

determined by the Sachs-le-Docte method with frequent checking of the results obtained by other standard methods, *e.g.*, precipitation of copper and alcohol extraction.

The results obtained are summarized in Tables V-VIII.

Conclusions.—In considering these results it must be borne in mind that the season 1927-28 was an abnormal one; this was reflected in the keeping qualities of the beet. The data obtained at all three centres indicate that, under adverse climatic conditions, beets, when stored either in clamps or under covered sheds, lose both moisture and total dry matter, and that beets crowned before storage may seriously deteriorate. This latter condition is mainly due to fungi which attack the beets on the cut surface left by crowning. It also appears probable that a greater loss is sustained by secondary growth in imperfectly cut or in uncrowned beets.

TABLE V.—BRISTOL. DATA OBTAINED FROM BEET IN CLAMP, 1928-1929

Sample No.	Date of clamping	Date removed from clamp	Period stored	Weight at clamping	Weight at laboratory after removing from clamp	Weight at laboratory after removing from clamp as percentage of weight at clamping	Dry matter at time of removing from clamp	Dry matter as percentage of original dry matter	Sucrose at time of removal	Sucrose as percentage of sucrose in original beet
			Days	lb.	lb.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1	Nov. 12	Nov. 12	0	65	64	98.5	26.5	100.0	18.5	100.0
2	" 12	" 26	14	62	60	96.8	26.6	100.4	19.2	103.8
3	" 12	Dec. 10	28	65	62	95.4	26.7	100.8	19.2	103.8
4	" 12	" 22	40	70	65	92.9	30.0	113.2	21.8	117.8
5	" 12	Jan. 7	56	66	63	95.5	29.0	109.4	21.2	114.6
6	" 12	" 21	70	61	60	98.4	27.6	104.2	19.9	107.6
7	" 12	Feb. 4	84	68	65	95.6	26.0	98.1	18.4	99.5

TABLE VI.—CAMBRIDGE. DATA OBTAINED FROM BEET 1928-1929

Sample No.	Date of clamping	Date removed from clamp	Period stored	Weight at clamping	Weight at laboratory after removing from clamp	Weight at laboratory after removing from clamp as percentage of weight at clamping	Dry matter at time of removing from clamp	Dry matter as percentage of original dry matter	Sucrose at time of removal of beet	Sucrose as percentage of sucrose in original beet
			Days	lb.	lb.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
S 1	Nov. 21	Nov. 22	0	59	59	100.0	25.0	100.0	17.5	100.0
S 5	" 21	Dec. 6	14	51	52	102.0	24.6	98.4	17.1	97.7
S 9	" 21	" 20	28	58	56	96.6	25.4	101.6	18.1	103.5
S 13	" 21	Jan. 3	42	56	56	100.0	25.5	102.0	18.5	105.7
S 17	" 21	" 17	56	52.5	49.5	94.3	25.5	102.0	18.0	102.9
S 21	" 21	" 31	70	58.25	56.5	97.0	23.5	94.0	17.8	101.7
S 25	" 21	Feb. 14	84	56.5	53.5	94.7	24.7	98.8	17.6	100.6
S 3	" 21	Dec. 6	14	55.5	55	99.1	25.3	101.2	17.6	100.6
S 7	" 21	" 20	28	48.5	48	99.0	25.0	100.0	17.7	101.2
S 11	" 21	Jan. 3	42	56.5	54	95.6	26.2	104.8	18.7	106.9
S 15	" 21	" 17	56	66.5	64	96.3	26.1	104.6	18.4	105.2
S 19	" 21	" 31	70	55.5	48.5	87.4	26.3	105.2	19.1	109.1
S 23	" 21	Feb. 14	84	51.5	44	85.5	28.0	112.0	19.1	109.1

TABLE VII.—CAMBRIDGE. DATA OBTAINED FROM FEN BEET, 1928-1929

Sample No.	Date of clamping	Date removed from clamp	Period stored	Weight at clamping	Weight at laboratory after removing from clamp	Weight at laboratory after removing from clamp as percentage of weight at clamping	Dry matter at time of removing from clamp	Dry matter as percentage of original dry matter	Sucrose at time of removal	Sucrose as percentage of sucrose in original beet
			Days	lb.	lb.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
S 6	Nov. 21	Dec. 6	14	95	93.5	98.4	21.1	95.0	13.8	87.3
S 10	" 21	" 20	28	78.5	77	98.1	22.1	99.5	14.8	93.7
S 14	" 21	Jan. 3	42	85	81.5	95.9	22.1	99.5	15.1	95.6
S 18	" 21	" 17	56	81.5	76.5	93.9	20.8	93.7	13.6	86.1
S 22	" 21	" 31	70	79.5	79	99.4	20.6	92.8	13.6	86.1
S 26	" 21	Feb. 14	84	87	81	93.1	21.7	97.7	14.8	93.7
S 2	" 21	—	0	85	85	100.0	22.2	100.0	15.8	100.0
S 4	" 21	Dec. 6	14	80.5	77	95.7	21.5	96.8	14.0	88.6
S 8	" 21	" 20	28	88	83	94.3	22.3	100.4	15.5	98.1
S 12	" 21	Jan. 3	42	81	78.5	96.9	22.4	100.9	15.2	96.2
S 16	" 21	" 17	56	79	74.5	94.0	22.4	100.9	14.8	93.7
S 20	" 21	" 31	70	84.5	74	87.6	23.4	105.4	16.7	105.7
S 24	" 21	Feb. 14	84	74.5	62	83.2	24.5	110.4	16.9	106.9

TABLE VIII.—OXFORD. DATA OBTAINED FROM BEET IN CLAMP, 1928-1929

Sample No.	Date of clamping	Date removed from clamp	Period stored	Weight at clamping	Weight at laboratory after removing from clamp	Weight at laboratory after removing from clamp as percentage of weight at clamping	Dry matter at time of removing from clamp	Dry matter as percentage of original dry matter	Sucrose at time of removal of	Sucrose as percentage of sucrose in original beet
			Days	lb. 50 Beet	lb. stored in	Per cent. nets.	Per cent.	Per cent.	Per cent.	Per cent.
1	Dec. 15	Dec. 15	0	74	73	100.0	26.4	100.0	19.5	100.0
2	" 15	" 31	16	75	74	98.6	26.2	98.1	19.5	100.0
3	" 15	Jan. 14	30	72	71	98.7	25.6	97.0	19.6	100.5
4	" 15	" 28	44	74	73	98.6	25.9	97.1	19.8	101.5
5	" 15	Feb. 11	58	74	73	98.6	26.4	100.0	19.8	101.5
6	" 15	" 25	72	74	73	98.6	25.7	97.3	19.6	100.5
		Mar. 11	86	74	73	98.6	25.6	97.0	19.5	100.0
1	15	50 Dec. 15	Beet individually labelled and distributed throughout clamp.	74	73	100.0	26.4	100.0	19.5	100.0
2	" 15	" 31	16	75	74	98.6	25.9	99.4	19.5	100.0
3	" 15	Jan. 14	30	72	70	98.7	26.2	98.1	19.5	100.0
4	" 15	" 28	44	68	66	97.2	27.0	102.2	19.7	101.0
5	" 15	Feb. 11	58	71	66	97.0	26.4	100.0	19.5	100.0
6	" 15	" 25	72	69	66	93.0	25.7	97.3	frozen and unworkable	
		Mar. 11	86		68	98.5		frozen and unworkable		

Either or both of these factors may cause a diminution of the commercial sugar yield.

The results obtained in the season 1928-29, however, tend to show how much climatic changes affect the condition of beets during storage. In contradistinction to the abnormality of the season 1927-28, the year 1928-29 appears more representative of normal English weather. The loss sustained by beets stored under the conditions obtaining during the second season may be considered as very small; but experimental evidence is lacking as to the physical characteristics and disease-resisting powers of beets grown under varying climatic and edaphic conditions. There seems reason to suppose that, if economic considerations allow, and if the season is as favourable as 1928-29, sugar beet can be stored in clamps without serious loss to the grower.

(To be continued.)

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ARTIFICIAL ILLUMINATION TO INCREASE WINTER EGG PRODUCTION

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THE length of the working day for the laying hen has a very marked influence upon her egg production. By using electric lamps or by other means of supplying light, the working day may be so extended that more food can be consumed, and, consequently, a larger amount of nutrients are available for making eggs.

In the United States and Canada the use of artificial illumination in the control of egg production is accepted. Numerous experiments have shown its possibilities and limitations. At Lincoln, Nebraska, U.S.A., for example, 90 Single Comb White Leghorn Pullets were placed in each of two houses of identical type, similarly equipped. Food and conditions were the same. The pen lighted from five o'clock in the morning until daylight produced 4,995 eggs, and the unlighted pen 3,933, a difference in the favour of the lighted birds of 1,062 eggs. As these eggs were laid at a period of the highest prices the additional eggs from the lighted pen brought 35 dollars and 20 cents (almost £8) increased gross income. This amount will usually pay the increased food cost and the cost of the electricity and leave a satisfactory net return.

A similar experiment, but with late-hatched Single Comb White Leghorn pullets, was carried on from September 30, 1927, to August 31, 1928, at the National Institute of Poultry Husbandry, Newport, Salop. The study included the costs of food and electricity as well as the production of the birds under observation. The additional observations made included the influence on health, body weight, consumption of food, size of eggs, and moulting. The experiment was started by Mr. Bobby, until recently Senior Research Assistant at the Institute.

The Method of Management.—Two pens in the National Institute of Poultry Husbandry Multiple Unit House were used. Each pen is 20 feet square, similarly lighted, ventilated and equipped, except for electric lighting equipment. The run for each pen is about 100 feet by 200 feet. Pen No. 1 was equipped with two 40-watt gas-filled electric lights 10 ft. apart and 6 ft. from the floor. Each lamp was placed in an aluminium painted reflector, 16 in. in diameter and $4\frac{1}{2}$ in. deep. The light switch consisted of an alarm clock so arranged that, when the alarm sounded, its winding arm threw over a tumbler switch and made contact at the desired time. The circuit also contained a meter to register the number of units of electricity used. Pen No. 2 was not fitted for lighting.

The lights in Pen No. 1 were started on October 28, four weeks after the experiment commenced. The lights were gradually increased so that the fowls did not receive the maximum amount of light until the end of the first week. Throughout the winter months Pen No. 1 received the artificial illumination from 4 a.m. until daylight. The lights were gradually eliminated from March 16 to 27. The object was to give as near a 12-hour day the year round as was possible. Each pen contained 120 Single-Comb White Leghorn pullets selected from chickens hatched on May 10. The late-hatched pullets were purposely selected in order to study the effect of lighting on stock that was rather immature.

Methods of Feeding.—The early morning grain feed was put down in the litter the night before, about $\frac{1}{2}$ oz. per pullet being allowed. The second morning feed of similar amount was given about 10 o'clock. The evening feed, at about 3.30 to 4 p.m., amounted to approximately $1\frac{1}{2}$ oz. of grain per fowl. The mash was all fed dry in hoppers, so that the birds could consume all they wished. For the first month, and after March 1, the two pens received the same amount of grain, or about 12 lb. per 100 birds daily.

The scratch grain consisted of two parts by weight of wheat, one part of oats, and one part of maize. The dry mash mixture consisted of 56 lb. of thirds, 56 lb. of maize meal, 28 lb. of bran, and 14 lb. of meat meal. The birds had free access to granite grit, oyster shell, and water, and were given green feed in season.

Egg Production.—The lighted pen gave a high percentage production throughout the period that lighting was in operation. For about two months after the lights were discontinued, the unlighted pen gave the better results. For the final four months the lighted pen again took and maintained the lead. The percentage egg production of the two pens, based on the hen-day basis, is as follows :—

PERCENTAGE EGG PRODUCTION

Management	Pen No. 1 Lighted	Pen No. 2 Unlighted
October	3	2
November	19	18
November–December	32	28
December–January	44	38
January–February	65	53
February–March	72	62
March–April	72	73
April–May	72	73
May–June	67	69
June–July	66	61
July–August	61	55
August	48	45
Yearly average	51.7	48.45

For the winter months the 120 pullets under lights laid 20,195 eggs, 950 more eggs than an equal number of pullets without lights. For the 48 weeks the lighted pen laid 1,086 more eggs than the unlighted pen. The lighted pullets laid an average of 173.5 eggs and the unlighted pullets 161.0 eggs. Considering that the pullets were very backward at the time they went into the laying house, the production must be considered satisfactory.

Food Consumption.—The food consumption per bird was slightly higher throughout the trial in the lighted pen than in that unlighted. The birds in the lighted pen averaged 3.72 oz. of food consumed, and the unlighted pen 3.47 oz., per day. For the 48-week period, the lighted birds consumed 5 lb. 3 oz. more food per bird than the unlighted ones. The increased consumption of dry mash in the lighted pen indicates that the birds made use of the additional time allowed them to increase

their food consumption. The increased amount of food in the lighted pen cost £2 0s. 1½d.

Financial Returns.—The income from the lighted pen was £134 14s. 4d., and from the unlighted pen, £125 12s. 6d., a difference of £9 1s. 10d. The margin over food cost was £85 8s. 5½d. for the lighted pen and £78 6s. 9d., for the unlighted pen, a difference of £7 1s. 8½d. The margin per bird of income over food and lighting costs was 14s. 7d. in the case of the lighted pen and 13s. 3d. for the unlighted pen, a difference in favour of the lighted pen of 1s. 4d. per bird. The cost of lighting pen No. 1 at 7d. per unit was 2d. per bird, 34 units being used in the course of the experiment.

The conclusions were that, under the conditions of the experiment, late-hatched (May) pullets, given lights, responded to artificial illumination, especially in the winter period, and gave better production and profit over food and lighting costs than the unlighted pullets. The experiment also proved that satisfactory inexpensive devices may be arranged for automatic regulation of the lights, that a reasonable allowance of artificial illumination did not injure the health of the birds, and that food consumption and body weight is materially increased by the use of lights.

British poultry farmers are not using lights for poultry to the extent that seems justified by the results usually obtained. Sometimes, it is not practicable for artificial illumination to be used, on account of the farm lay-out not being sufficiently intensive or the cost of lighting being too high. Quite often the poultry farmer does not believe that increased results will be obtained.

Possibilities and Limitations.—Electric light is used primarily to lengthen the days that are abnormally short during the autumn and winter. The extra light during the months of November, December, and January gives essentially the same length of day as fowls usually get during the months of April and May, when the maximum production of eggs is received. There is little question that proper illumination and correct feeding are required for maximum returns and that the absence of one or the other greatly reduces production, profits, and health. Artificial light will not take the place of good breeding or proper feeding and management. It is not primarily a means of increasing annual egg production, but a means of changing the seasonal production of fowls to get them to produce when the price of eggs is highest. There is some indication that the use of lights enables fowls to keep in proper

physical condition and body weight so that they can lay more eggs in a year. When properly managed, one can conservatively estimate, from a 400-hen flock for the six months from October 1 to April 1, an increase in egg production of about 10 per cent. for quicker-maturing pullets, 7 per cent. for slower-maturing pullets, and 5 per cent. for yearling hens. For a 48-week period, one can expect the percentages to be about 2 to 4 per cent. higher for the lighted pens.

Time of Lighting.—It is not the main consideration whether the lights are given in the morning, twilight, or night. The length of day and the arrangement of the lights to get the proper brightness are of more consequence.

The lighting of the layers in the morning seems to be the most popular method in England. It is effective in promoting activity and increasing egg production because the birds are hungry at that time. It has the advantage that a very inexpensive tumbler switch and an alarm clock are all that are needed to bring the lights on. It is probably not so convenient or stimulating as the morning and twilight method. If rats are a trouble in the laying house, the fact that the grain is left in the litter or troughs over night may be conducive to some losses.

The "evening lunch" of an hour is economical in the use of lights and has many advocates. It has the disadvantage of being less convenient and less effective than the morning and evening lights combined, and requires more expensive regulating equipment than the morning lights.

The advantage of combining morning and evening lights lies in its convenience. The plan allows a reasonable working day for either the hired man or the flock owner, and gives the early riser an opportunity for food, water, and exercise. It is possible by this system to provide absolute regularity from early autumn until late spring, as it is not influenced in the least by the normal daily changing of twilight and dawn. It can be handled as morning and evening duties. It also divides the discharge of batteries between the night and morning, thus lightening the load on the generator and batteries where individual farm lighting plants are operated. The principal disadvantage it has over morning lighting only is that a more expensive and complicated switch or wiring system is required.

The Amount of Light to Give.—Best results can be expected from the use of lights if the fowls are graded and housed according to age, development and condition. Early pullets

in good body weight and of good breeding will want a high protein mash and light to make a 13-hour day to maintain 60 to 70 per cent. production.

Mature pullets of medium production capacity and in good weight will require 13 to 14 hours of light to give 50 per cent. production and not go to pieces. Later maturing pullets, or pullets relatively low in body weight, should have heavy grain feeding instead of high protein mashes and only a 12-hour day until mature and up to body weight. Old hens that are to be forced and then disposed of may be given a 13- to 14-hour day in the early autumn to keep them in production. August moulting hens that have got back their body fat and colour pigment can be given the 13- or 14-hour day in the latter part of October or November, depending upon the condition of the birds.

Breeders, on the other hand, should be thrown out of production to enable them to rest before the breeding season. Increased production of early hatching eggs can then be obtained by the use of lights on the breeders in January and February. The hatchability of the eggs will not be impaired by the proper use of lights.

The Arrangement of Lights.—Electric lamps are by far the most satisfactory method of lighting the poultry house. Other sources of light are the gasoline lantern, gas or acetylene lights and barn lanterns. The lamp should be so arranged that the maximum amount of light is on the floor. In order to get the birds off the roosts, it is also necessary to light the roosts. If the lamps are put from 6 ft. to 6 ft. 3 in. from the floor, they will be out of the way of the attendant, give the needed intensity of light on the floor, hoppers and water supply and light the roosts. The shape of the house will greatly influence the position of the lamps. The lights should be placed to give the least amount of shadow, be directly over the hoppers, if they are in the centre of the pen, and, as a general rule, should be half way between the front wall and the edge of the dropping boards, and not over 10 ft. apart.

The lighting unit consists of a lamp with a reflector. A simple reflector can be made of light-weight galvanized iron: it should be 4 in. deep and cone-shaped with a diameter of 16 in. The reflecting surface should be coated with aluminium paint. It is probably better to buy a standard dome reflector because of its greater efficiency. The wattage of the lamps required will depend upon whether the food is fed in the litter, in troughs, or in hoppers, the type of reflector used, and the type of lamp

used. If a standard dome reflector is used and gas-filled lamps, $\frac{1}{4}$ watt of lamp capacity for each square foot of floor space is enough. For example, a 20 ft. by 20 ft. pen has 400 square feet of floor space and requires a 100-watt lamp or two 50-watt lamps. Twice this allowance may under certain circumstances be advisable.

The control of the lights may be simple or very complicated. Large commercial poultry farms usually find it advisable to purchase an automatic time switch on a 15-day basis, or a special installation not requiring any regular adjustment. For morning lights on a small farm, a very inexpensive switch is all that is necessary. This consists of a standard tumbler switch mounted so that the alarm winding key of the clock will engage the tumbler switch. The morning and evening lights system and the "evening lunch" system require a dimming device. The two common methods of dimming lights in the poultry house are the two-circuit system and the resistance-unit system. In the two-circuit system, a second circuit, equipped with 10-watt lamps, is provided to furnish light for the fowls to go to roost after the regular lighting system is turned off. Three wires are necessary, one of which is connected to both circuits. A double-throw switch may be used for changing from full to dim lights. In the resistance-unit system the regular lights are dimmed by passing the current through some sort of resistance. Still another method of dimming is the series-parallel system. An electric range switch is convenient for operating this arrangement of lights, which is based on having the lights in series for full strength, and in parallel for dimming; a three-wire circuit is required.

The use of lights is closely linked with good breeding, feeding, housing, and management. One should never attempt to use lights unless willing to pay careful attention to all the necessary details of poultry husbandry. If properly handled, lights in the poultry house can be made to pay useful dividends.

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THE ERADICATION OF SLENDER FOXTAIL

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SLENDER Foxtail (*Alopecurus agrestis* L.), which is also known by such local names as Black Grass, Black Bent and Hunger Weed, is a very serious pest on arable land ; in fact, it appears in Long's list of the twelve worst weeds on arable land.* It is particularly prevalent on heavy land, although it will grow strongly on many types of soil. The writers have seen fields of wheat in the west of England almost completely smothered by this weed, resulting in a very poor crop. The plant is closely related to Meadow Foxtail (*A. pratensis* L.), which is a useful meadow grass somewhat similar in appearance to *A. agrestis*, which, however, is an annual and much more slender than Meadow Foxtail.

Slender foxtail flowers from May to October. This long flowering period, coupled with the facts that the weed chiefly occurs amongst corn crops, and that a portion of the seed is shed before the crop is cut, makes its eradication a difficult problem. It has been suggested that, as the weed is an annual, deep ploughing in the autumn will assist in its eradication. Field observations had led the writers to believe that the seeds of this weed were capable of retaining their capacity to germinate after they had been buried fairly deeply in the soil for twelve months and were then brought to the surface at a subsequent ploughing. In order to ascertain if this was the case, the experiment described below was commenced in the autumn of 1927.

Experimental Procedure.—On November 28, 1927, batches of 200 seeds of slender foxtail were placed in 10-in. earthenware flower-pots, which had been filled with soil. The pots were buried at depths of 5 in., 7 in. and 9 in. At the same time as the pots were buried, two lots of seed—each lot consisting of 5,000 seeds—were ploughed in to a depth of 8 in. During the period that the pots and seeds were under the ground, surface cultivations of the usual character were carried out. Another parcel of seed was stored in a glass jar for subsequent germination test. The test of the original seed showed a

* H. C. Long : *Common Weeds of the Farm and Garden*, Smith, Elder & Co., p. 233. (Now out of print.)

germination of 61 per cent. On November 28, 1928, *i.e.* one year after the seed had been buried, the pots were dug up and foreign soil carefully removed from the tops of the pots. The pots were then placed in a greenhouse and the seeds allowed to germinate. The area of land under which the two lots of 5,000 seeds had been buried was ploughed up again. This procedure would bring to the surface a large number of the seeds that had been buried a year before. At the same time, a germination test was made of the seeds that had been stored in the glass jar, and as a result of this test it was found that the germination capacity of the seed had decreased to 56 per cent., indicating that during twelve months there had been a decrease in the germination capacity of the seed to the extent of $8\frac{1}{2}$ per cent. of the original seed.

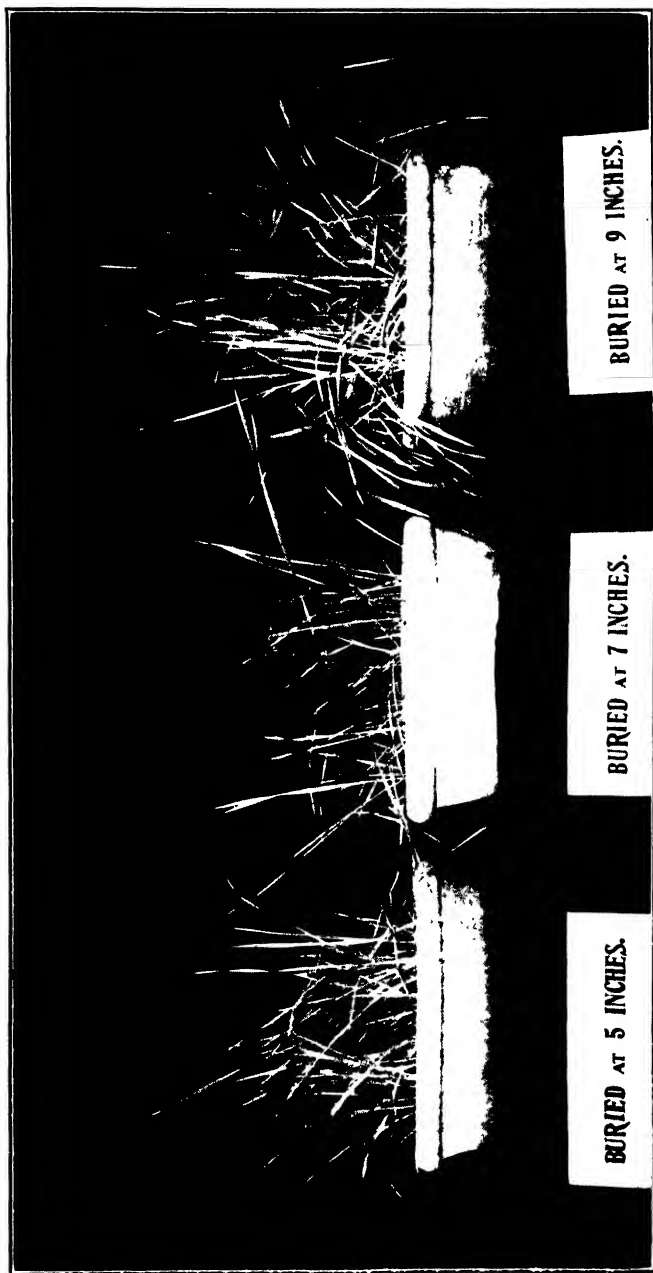
Periodically, the young blackgrass plants in the pots and the ploughed-up area were pulled up and counted, and the table below contains the average counts of all the plots and the two ploughed-up areas at each sampling period:—

TABLE GIVING NUMBER OF PLANTS GERMINATED

Date of count	Pots			Ploughed area
	Depth 5 in.	of burying 7 in.	9 in.	Depth of burying 8 in.
1928, December 17	12	12	24	—
" " 29	12	19	25	—
1929, February 16	11	16	32	—
" March 4 ..	—	—	—	31
" " 15 ..	—	—	—	10
" May 14 ..	—	—	—	4
Total ..	35	47	81	45
Per cent. of total buried	17.5	23.5	40.5	0.9

Consideration of the above data shows that comparatively deep burying of the seed tends to preserve it, with the result that after twelve months under the ground the seed is capable of germination, and that the deeper the seed is buried—within limits—the better it is preserved. It was also noticed that the plants from the seeds buried at the greater depths were more vigorous. This is clearly shown in the accompanying illustration from a photograph taken on March 4, 1929.

It is thought that many of the seeds buried at the shallower depths may germinate during the first spring, but owing to



Showing vigour of Slender Foxtail plants varying according to the depth at which seeds were planted.

THE ERADICATION OF SLENDER FOXTAIL.

the effect of the surface cultivations and other conditions, they do not succeed in developing into plants.

It is interesting to note that, on the ploughed area, only 45 healthy plants were obtained. When it is borne in mind that one plant, under favourable conditions, will produce upwards of a thousand seeds the problem becomes a serious one, but as 10,000 seeds were sown and ploughed down the fact of so few germinating is very gratifying. Nevertheless, if the germination is 1 per cent., and each plant produces upwards of 1,000 seeds, this will give 10 seedlings from the mother plant which may be serious.

Following the dry season of 1929, which was favourable for seeding, but not for germination, it is probable that black grass will be particularly prevalent in 1930.

Method of Eradication.—Prevention is always better than cure, and every effort should be made to prevent introduction of the weed seeds into the field, by observing the following precautions :—

- (1) Clean seed corn should be used.
- (2) The screenings, etc., from the thrashing drum should be burnt to prevent possible contamination through the medium of the dung cart.
- (3) The seeds of the weed are sometimes present as an impurity in grass seed mixtures, therefore when sowing under corn as a nurse crop, clean mixtures should be employed.
- (4) If slender foxtail is present in the hedgerows and headlands seeding should be prevented by cutting. Once the plant becomes established drastic methods must be adopted to secure complete eradication, and in some cases this may extend over several seasons.

As black grass is an annual, if the infected corn crop is followed in the rotation by roots, the seeding can be prevented by persistent horse and hand hoeing. This will deal with the top layer, but the buried seeds will still have to be dealt with when brought to the surface in subsequent seasons.

Continual cropping with spring-sown in place of autumn-sown crops will generally eradicate the weed, but on some land it will encourage charlock, etc. Also, on many soils spring-sown crops are not suitable, and it may be necessary to follow wheat with winter oats or winter barley. The experiment noted above indicates that deep burying will not kill *all* the slender foxtail seeds, but rather tend to preserve their vitality,

as compared with burying at a shallow depth, thus enabling them to germinate freely when brought to the surface.

An effective method would be that recommended for the treatment of many annual weeds, *i.e.* provided the season is favourable, the germination of seeds should be encouraged on the stubble, the seedlings being destroyed by subsequent cultivation. For this to be effective the stubbles should be skimmed immediately after the wheat crop has been harvested and the preparatory cultivations for the winter-sown corn crop delayed, within practical limitations, for as long a period as possible. In some instances intermittent harrowings would doubtless be advisable.

Top dressing in early spring with a nitrogenous fertilizer, particularly calcium cyanamide, has been found effective in checking black grass, the stimulated corn crop tending to smother the weed. The writers also noted the same effect on black grass when wet-spraying a wheat crop with sulphate of ammonia for the destruction of Corn Buttercup (*Ranunculus arvensis*).

Thanks and acknowledgments are due to Mr. Richard Stratton, chairman of the Wiltshire Agricultural Education Committee, at whose instigation the trials were carried out ; also to Mr. G. T. Spinks, of the Long Ashton Agricultural and Horticultural Research Station, who conducted the germination tests.

* * * * *

CEREALS FOR SPRING SOWING

THE following note has been communicated by the National Institute of Agricultural Botany, Cambridge :—

The lower the prices that cereals realize, the more important it is to grow the varieties that will bring the best return. The Institute is constantly engaged in conducting trials and observation plots in typical arable districts in the Midlands and south of England. From the results so obtained and the information provided by Agricultural Organizers in many counties it is now in a position to advise farmers on the merits of almost all the varieties at present on the market. The positive recommendations in the following notes are all based on careful trials, except in the case of spring wheats. Considerations of space make it impossible to refer to every variety or to state the evidence for and against the varieties actually mentioned ; but those who require more information than is given here can obtain it by writing to the Institute at Cambridge.

These notes do not necessarily apply to the north of England,

Spring Wheats.—Spring wheat, that is to say wheat sown after the middle of February, is not often a profitable crop. If it must be grown, *April-Bearded* is the variety which is most likely to ripen at a reasonably early date ; it is generally ready at least a week before any other, it gives the best quality grain, and is capable of giving a respectable yield, but it does not stand well. *Red Marvel* has a shorter and stronger straw, and yields about the same, but in other respects is inferior. *A.1* seems as though it would yield rather better than either of the above, and it may stand a little better ; it ripens about the same time as *Red Marvel*. *Hybrid 23* ripens a week or more after *Red Marvel* and on this account is certainly not suitable for sowing as late as March. Of the other varieties offered as spring wheat some are indistinguishable in the field from one or other of the above, and the rest are inferior. All the spring wheats are susceptible to disease and are apt to suffer from loose smut.

Spring Barleys.—Another season's work has made it clear that, if the north of England and very exceptional circumstances be excluded, farmers who aim at growing malting barley should confine their choice to *Plumage-Archer* or *Spratt-Archer*. Trials to determine the conditions in which either of these is to be preferred to the other are still in progress. For the present, farmers may be advised to choose *Plumage-Archer* for the most fertile soils, owing to its rather stronger straw, and *Spratt-Archer* where fertility is low ; but it is not yet possible to say which is likely to give the better cash return elsewhere.

If a farmer is unable to sow until very late and, consequently, needs an unusually early-ripening barley, it may be worth while trying *Victory*, which is ready about ten days before *Plumage-Archer*, stands satisfactorily, and seems likely to give a fair yield of nice quality grain.

Spring Oats.—There are more varieties for the farmer to consider in the case of oats. *Abundance* almost always gives a respectable yield and as regards quality is the standard by which all other varieties are judged. Its intrinsic and its market value are alike excellent. It is, however, apt to lodge on rich soils, and any of the other four varieties recommended in this paragraph usually outyield it. *Victory* is perhaps as profitable a variety as any ; it generally outyields *Abundance* by more than 10 per cent., it is slightly stronger in the straw, and though not of quite the same intrinsic quality it realizes

much the same market price. *Golden Rain* may be particularly recommended to those who intend to feed the crop on the farm. It has slightly better straw than *Victory*, and yields as well; it ripens a day or two earlier than the other varieties here recommended, and is of good intrinsic quality, but owing to its golden colour the market price is sometimes reduced. *Thousand Dollar* has a stouter straw than any of the above, and responds better than *Abundance* to high farming. Its grain, though not in fact quite as good as that of *Abundance*, is valued at about the same figure on the market. Finally, on very rich soils *Marvellous* is more likely to stand than any other variety. It can give very big yields, but it must be sown very early. Both its straw and its grain are coarse.

It should be said that more information is required about the newer sorts before any of them can be recommended. *Progress*, *Star* and *Golden Rain II* are the most promising, but such figures as are so far available from trials do not suggest that they are very likely to replace present favourites. Of other varieties mention is unnecessary except in the case of *Black Tartarian*; only on poor or high-lying fields where other varieties will not thrive is it still worth growing.

One may usefully add that, under favourable conditions, almost any variety of wheat, barley, or oats will give a good yield. Varieties are often recommended on the strength of the exceptional crops which they give in such circumstances, but it by no means follows that they are therefore the best varieties to grow. Such information can only be derived from the combined experience of a large number of farmers over a series of years, or from carefully planned trials and observation plots at a number of centres. Farmers are therefore recommended, before sowing a variety of which they have happened to see a good crop, to inquire from the Institute how the variety behaves when grown side by side with other sorts under controlled conditions.

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MARKETING NOTES

MARKETING UNDER THE NATIONAL MARK

National Mark Egg Scheme.—In order to afford guidance to retailers and others who obtain National Mark supplies through the wholesale trade, it has been decided that the date of packing shall be code-marked on the outside of each case of National Mark eggs and recorded on a check slip inside the case. This arrangement will take effect on January 1, 1930, and the code to be used will consist of two letters—the first to indicate the week in the year and the second the day in the week. The letters of the alphabet from A-Z shall be taken to indicate the first 26 weeks of the year and will be repeated for the last 26 weeks. The first six letters of the alphabet, A-F, shall be used respectively to indicate the days of the week (Monday to Saturday). *Example*: January 1, 1930 (Wednesday)=AC.

The code date is to be over-stamped upon the National Mark label, in the left-hand bottom space below the grade designation, the letters being $\frac{3}{8}$ -in. in height. A reproduction of the code dating calendar is appended.

A check slip or delivery note must be enclosed in every container, except in cartons containing one dozen or half-a-dozen eggs.

NATIONAL MARK EGG SCHEME: CODE DATING CALENDAR, 1930

<i>January</i>		<i>February</i>	
Mon. ..	6-BA 13-CA 20-DA 27-EA	3-FA 10-GA 17-HA 24-IA	
Tues. ..	7-BB 14-CB 21-DB 28-EB	4-FB 11-GB 18-HB 25-IB	
Wed. ..	1-AC 8-BC 15-CC 22-DC 29-EC	5-FC 12-GC 19-HC 26-IC	
Thur. ..	2-AD 9-BD 16-CD 23-DD 30-ED	6-FD 13-GD 20-HD 27-ID	
Fri. ..	3-AE 10-BE 17-CE 24-DE 31-EE	7-FE 14-GE 21-HE 28-IE	
Sat. ..	4-AF 11-BF 18-CF 25-DF	1-EF 8-FF 15-GF 22-HF	
<i>March</i>		<i>April</i>	
Mon. ..	3-JA 10-KA 17-LA 24-MA 31-NA	7-OA 14-PA 21-QA 28-RA	
Tues. ..	4-JB 11-KB 18-LB 25-MB	1-NB 8-OB 15-PB 22-QB 29-RB	
Wed. ..	5-JC 12-KC 19-LC 26-MC	2-NC 9-OC 16-PC 23-QC 30-RC	
Thur. ..	6-JD 13-KD 20-LD 27-MD	3-ND 10-OD 17-PD 24-QD	
Fri. ..	7-JE 14-KE 21-LE 28-ME	4-NE 11-OE 18-PE 25-QE	
Sat. ..	1-IF 8-JF 15-KF 22-LF 29-MF	5-NF 12-OF 19-PF 26-QF	
<i>May</i>		<i>June</i>	
Mon. ..	5-SA 12-TA 19-UA 26-VA	2-WA 9-XA 16-YA 23-ZA 30-AA	
Tues. ..	6-SB 13-TB 20-UB 27-VB	3-WB 10-XB 17-YB 24-ZB	
Wed. ..	7-SC 14-TC 21-UC 28-VC	4-WC 11-XC 18-YC 25-ZC	
Thur. ..	1-RD 8-SD 15-TD 22-UD 29-VD	5-WD 12-XD 19-YD 26-ZD	
Fri. ..	2-RE 9-SE 16-TE 23-UE 30-VE	6-WE 13-XE 20-YE 27-ZE	
Sat. ..	3-RF 10-SF 17-TF 24-UF 31-VF	7-WF 14-XF 21-YF 28-ZF	
<i>July</i>		<i>August</i>	
Mon. ..	7-BA 14-CA 21-DA 28-EA	4-FA 11-GA 18-HA 25-IA	
Tues. ..	1-AB 8-BB 15-CB 22-DB 29-EB	5-FB 12-GB 19-HB 26-IB	
Wed. ..	2-AC 9-BC 16-CC 23-DC 30-EC	6-FC 13-GC 20-HC 27-IC	
Thur. ..	3-AD 10-BD 17-CD 24-DD 31-ED	7-FD 14-GD 21-HD 28-ID	
Fri. ..	4-AE 11-BE 18-CE 25-DE	1-EE 8-FE 15-GE 22-HE 29-IE	
Sat. ..	5-AF 12-BF 19-CF 26-DF	2-EF 9-FF 16-GF 23-HF 30-IF	

<i>September</i>			<i>October</i>		
Mon. ..	1-JA	8-KA 15-LA 22-MA 29-NA	6-OA 13-PA 20-QA 27-RA		
Tues. ..	2-JB	9-KB 16-LB 23-MB 30-NB	7-OB 14-PB 21-QB 28-RB		
Wed. ..	3-JC	10-KC 17-LC 24-MC	1-NC 8-OC 15-PC 22-QC 29-RC		
Thur. ..	4-JD	11-KD 18-LD 25-MD	2-ND 9-OD 16-PD 23-QD 30-RD		
Fri. ..	5-JE	12-KE 19-LE 26-ME	3-NE 10-OE 17-PE 24-QE 31-RE		
Sat. ..	6-JF	13-KF 20-LF 27-MF	4-NF 11-OF 18-PF 25-QF		
<i>November</i>			<i>December</i>		
Mon. ..	3-SA	10-TA 17-UA 24-VA	1-WA 8-XA 15-YA 22-ZA 29-AA		
Tues. ..	4-SB	11-TB 18-UB 25-VB	2-WB 9-XB 16-YB 23-ZB 30-AB		
Wed. ..	5-SC	12-TC 19-UC 26-VC	3-WC 10-XC 17-YC 24-ZC 31-AC		
Thur. ..	6-SD	13-TD 20-UD 27-VD	4-WD 11-XD 18-YD 25-ZD		
Fri. ..	7-SE	14-TE 21-UE 28-VE	5-WE 12-XE 19-YE 26-ZE		
Sat. ..	1-RF	8-SF 15-TF 22-UF 29-VF	6-WF 13-XF 20-YF 27-ZF		

National Mark Malt Products Scheme.—The Minister has appointed a National Mark Malt Products Trade Committee to consider applications for permission to use grade designation marks prescribed by regulations made under the Agricultural Produce (Grading and Marking) Act, 1928, in connexion with All-English Malt Flour and Malt Extract. The Committee will make recommendations to the National Mark Committee (Lord Darling's Committee) with regard to such applications, and advise the Ministry and the National Mark Committee generally as to the use of such marks in connexion with All-English Malt Products.

The members of the Committee are: Sir John Pakeman, C.B.E. (Chairman), Mr. F. J. Bearman, Mr. E. C. Cripps, Mr. J. Garton, Mr. J. Lord, Mr. T. E. Lescher, Mr. H. H. Marshall, Mr. E. W. K. Slade and Mr. G. Stubbs. The Secretary of the Committee is Mr. B. A. Tyson, of the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

Full details of the scheme were given in the last (December) issue of the JOURNAL. The Trade Committee have considered applications for enrolment as authorized packers and have, so far, recommended the issue of certificates of authorization in the case of 31 applicants, whose names, addresses and packing premises are as follows:—

<i>Name</i>	<i>Address</i>	<i>Address of Authorized Packing Premises</i>
<i>London</i>		
Anglo-American Oil Co., Ltd.	Albert Street, Camden Town, N.W. 1.	Albert Street, Camden Town, N.W. 1.
Allen & Hanburys, Ltd.	Bethnal Green, E. 2.	Bethnal Green, E. 2. Ware Mills, Ware.
Baiss Bros. & Co., Ltd.	175 Grange Road, Bermondsey, S.E. 1.	175 Grange Road, Bermondsey, S.E. 1.
The British Malt Products Co., Ltd.	Lothian House, 1 Market Street, Bermondsey, S.E. 1.	Lothian House, 1 Market Street, S.E. 1. Willow Mills, Clayton-le-Moors, Accrington, Lancs.
		The Refinery, West-boras, Dunbar, N.B.

<i>Name</i>	<i>Address</i>	<i>Address of Authorized Packing Premises</i>
The British Drug Houses, Ltd.	16-32 Graham Road, City Road, N. 1.	16-32 Graham Road, City Road, N. 1.
Burgoyne, Burbidges & Co., Ltd.	High Street South, East Ham, E. 6.	High Street South, East Ham, E. 6.
Edme Ltd.	122 Regent Street, W. 1.	Edme Works, Mistley, Essex.
C. R. Harker, Stagg & Morgan, Ltd.	Emmott Street, Mile End, E. 1.	Emmott Street, Mile End, E. 1.
Thos. Hodgkinson, Prestons & King.	262 Bishopsgate, E.C.2.	262 Bishopsgate, E.C.2. Besson Street, New Cross Gate, S.E. 14.
May Roberts & Co., Ltd.	7-13 Clerkenwell Road, E.C. 1.	Springfield, Upper Clapton, E. 5.
The United Yeast Co., Ltd.	238-240 City Road, E.C. 1.	238-240 City Road, E.C. 1. 80 Miller Street, Manchester. Doe Street, Birmingham. 103 Temple Street, Bristol. Unecol House, York Street, Leeds. Corporation Street, Newcastle-on-Tyne.
Wright, Layman & Umney, Ltd.	44 Southwark Street, S.E. 1.	44-50 Southwark St., S.E. 1. 60-72 Park Street.
A. Wander, Ltd.	184 Queens Gate, S.W. 7.	Kings' Langley, Herts.
<i>Bedfordshire</i>		
Muntona, Ltd.	Muntona Works, Bedford.	Muntona Works, Bedford.
<i>Derbyshire</i>		
Richard Daniel & Son, Ltd.	Mansfield Road, Derby.	Mansfield Road, Derby.
<i>Hertfordshire</i>		
H. A. & D. Taylor, Ltd.	Sawbridgeworth.	British Dia Malt Company Factory, Sawbridgeworth. Maltine Manufacturing Co., Ltd., Packing Factory, 23 Longford St., London, N.W. 1. Store and Labelling Factory, Rail 3 Malt-ing, Sawbridgeworth.
<i>Hunts</i>		
Paine & Co., Ltd.	St. Neots.	Malt Extract Factory, Bedford Street, St. Neots. Malt Extract Factory, Brook St., St. Neots. John Bull Mills, Market Square, St. Neots.

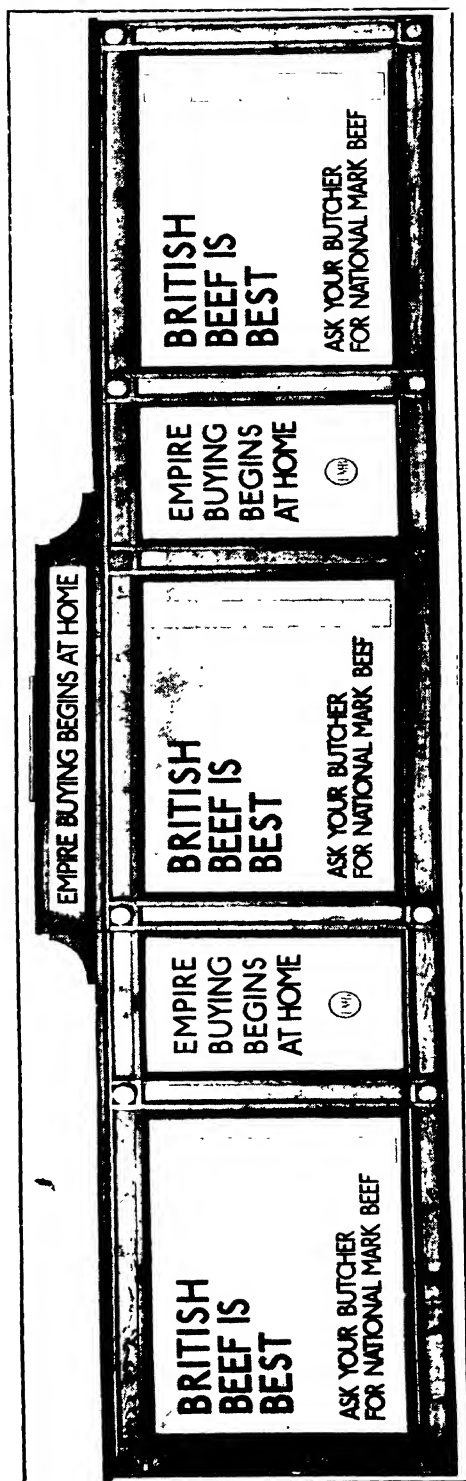
<i>Name</i>	<i>Address</i>	<i>Address of Authorized Packing Premises</i>
Lancashire		
Ayrton, Saunders & Co., Ltd.	34 Hanover Street, Liverpool.	34 Hanover Street, Liverpool.
Evans, Sons, Lescher & Webb, Ltd.	56 Hanover Street, Liverpool.	56 Hanover Street, Liverpool.
Charles William Harper.	254 Stockport Road, Manchester.	254 Stockport Road, Manchester.
Jeffreys, Miller & Co., Ltd.	Leyland Mills, near Wigan	Leyland Mills, near Wigan.
Leicestershire		
E. H. Butler & Son.	93 Humberstone Gate, Leicester.	93 Humberstone Gate, Leicester.
Shropshire		
The United Malting Co.	Wem.	Wem.
Suffolk		
Edward Fison, Ltd.	The Maltings, Ipswich.	The Maltings, Ipswich.
Warwickshire		
Southall Bros. & Barclay, Ltd.	19-21 Lower Priory, Birmingham.	19-21 Lower Priory, Birmingham.
Yorks		
Lofthouse & Saltmer, Ltd.	Hull.	Hull.
T. J. Smith & Nephew, Ltd.	5 Neptune Street, Hull.	Paragon Works, Neptune Street, Hull.
Goodall, Backhouse & Co.	White Horse Street, Leeds.	9 Whitehorse Street, Leeds.
Raimes & Co.	Micklegate House, York.	Micklegate House, York.
		Cromwell Road, York.
Scotland		
The Distillers Co., Ltd.	12 Torphichen Street, Edinburgh.	Kirkliston Distilleries, West Lothian.
Harkness, Beaumont & Co.	Junction Bridge, Leith, Edinburgh.	Junction Bridge, Leith, Edinburgh.

National Mark Beef Scheme.—The number of sides graded and marked from the commencement of the scheme (*i.e.* London and Birmingham, October 4; Scotland, October 28, and Birmingham, November 16) to December 7 was as follows :—

For the London Area

(including Scotch and Birkenhead-killed beef)	Select	..	..	..	7,110
	Prime	..	..	..	4,059
	Good	..	..	..	1,485
Total					12,654

<i>Birmingham</i>	Select	..	..	..	557
	Prime	..	..	..	690
	Good	..	..	..	220
Total					1,467



The Empire Marketing Board's display of posters advertising National Mark Beef. (See page 977.)

The number of sides *graded* each week since the week ended November 9 has been as follows :—

<i>Week ended</i>	<i>Select</i>	<i>Prime</i>	<i>Good</i>	<i>Total Sides graded (Quarters and pieces omitted)</i>
<i>London</i>				
November 16 ..	509	1,073	188	1,770
„ 23 ..	460	1,144	232	1,836
„ 30 ..	529	828	165	1,522
December 7 ..	603	793	229	1,625
<i>Birkenhead*</i>				
November 16 ..	—	112	101	213
„ 23 ..	—	136	81	217
„ 30 ..	—	138	67	205
December 7 ..	—	200	109	309
<i>Scotland*</i>				
November 16 ..	774	197	—	971
„ 23 ..	642	191	—	833
„ 30 ..	695	159	—	854
December 7 ..	897	158	—	1,055
<i>Birmingham</i>				
November 16 ..	22	121	40	183
„ 23 ..	354	466	392	1,212
„ 30 ..	400	783	367	1,550
December 7 ..	249	483	117	849

* Sides consigned to Smithfield Market, London.

The number of butchers on the roll of London meat traders regularly selling National Mark beef on December 7 was 217, representing 509 shops, and on the Birmingham roll 214 traders, representing 390 shops.

During December, extensive publicity was arranged by the Empire Marketing Board in support of National Mark beef in London and Birmingham. All the Board's frames in numerous public places in London and Birmingham bore posters inviting the public to ask for it. A set of the posters so displayed is shown in the accompanying illustration. Attractive posters for shop display were prepared and distributed to the butchers on the Ministry's rolls for London and Birmingham. Local Press advertising was also used in certain areas and special canvassing of butchers was undertaken.

In the United States, where a beef grading and marking scheme on somewhat similar lines to the London and Birmingham schemes is in operation, experience has shown that :—

- (i) the number of wholesalers having beef graded and marked steadily increases ;
- (ii) retailers who handle the graded and marked beef consistently report increases in sales ;

- (iii) consumers who have once bought graded and marked meat seldom buy any other ; and
- (iv) greater price differentiation becomes apparent between the best beef and beef of the lower grades.

It can now be said that the London and Birmingham experiments have gone far enough to indicate that the same results will follow in this country. As regards the two first points, it is already the case that practically all the wholesalers in both centres in the beef trade now supply graded and marked beef, and in cases where the retailers have pushed the sale of graded and marked beef, with the help of the posters and leaflets supplied by the Ministry, reports of increased trade have almost invariably followed. Consumers of British beef are definitely acquiring the habit of insisting on having marked supplies, while price differentiation according to grade is beginning to reveal itself to an increasing extent. Whereas "Select" beef at the commencement of the experiment did not average more than 1d. per lb. above the level of the "Good" grade, "Select" beef is now making about 1½d. per lb. more on the wholesale market. This difference is roughly equivalent to 26s. per carcass over and above the spread, prior to the initiation of the scheme, between the best and average quality beef on the market.

National Mark Wheat Flour Scheme.—The number of firms who have received certificates of authorization from the National Mark Committee to pack All-English Wheat Flour under the National Mark is now 158, a figure which bears witness to the keenness with which the scheme has been taken up by millers throughout the country. During November and December, a special effort was made by the Empire Marketing Board and the Ministry to gain the active interest of retailers and the general public. Intensive advertising in the trade papers and the general Press, together with a wide distribution of an attractive booklet on "The National Mark," have kept the scheme well before the notice of retailers and householders.

Considerable attention was again devoted to the National Mark Flour Scheme in one of the Ministry's fortnightly broadcast talks. Reference was then made to a Report presented to the Council of Agriculture by its Standing Committee on Marketing, one recommendation of which was that the public should be informed of the fact that the flour from British wheats was becoming increasingly valuable as a bread-maker, and that most home-grown wheats of the 1929 crop gave results which were very satisfactory in regard to breakmaking

qualities. An announcement that the Ministry would supply a recipe for the home-baking of bread from National Mark "Yeoman" Flour was followed by some hundreds of applications and by inquiries as to where flour of the "Yeoman" grade could be obtained. Following the favourable comments made by the judges at the Bakers' Exhibition, in September, upon the entries in the classes for bread made from All-English flour, the Ministry has received encouraging reports from bakers who have thoroughly tested "Yeoman" grade National Mark flour in commercial bread-making. A considerable number of bakers are now prepared to supply customers regularly with bread baked from National Mark flour. A list of their names is being compiled, and the Ministry will be glad to receive further names for entry on the list.

During December, the Ministry circulated an inquiry to authorized millers and packers asking for information as to the demand for National Mark flour, and as to their sales of All-English flour, during the preceding two months, compared with the corresponding period last year. The replies showed that, in many districts, the effect of the National Mark Flour Scheme had not yet been felt by millers in the form of increased demand for All-English flour. On the other hand, about 30 firms reported an increase in sales of English flour, ranging from slight to very large increases. As the full effect of the recent publicity campaign had not then been felt and the scheme had only been in operation for two months, this result must be regarded as satisfactory. Coupled with the reports of progress under the scheme were expressions of opinion as to the high quality of National Mark flour.

Cornish Broccoli Export Scheme.—Amended Regulations under the Agricultural Produce (Grading and Marking) Act, 1928, have been prepared for the 1930 broccoli season. The regulations come into force on January 6, 1930, and it is expected that Cornish broccoli will be exported to Continental markets under the National Mark Scheme during the months from January to April, 1930. Certificates of authorization to pack under the National Mark will be issued by the National Mark Committee to approved applicants who undertake to comply with the conditions of the scheme, and arrangements for the enrolment of packers are in progress.

Only "First Quality" broccoli, as defined in the regulations quoted above, may be exported under the Scheme, and certain conditions as to packing, dispatch of consignments, etc., are laid down. The Ministry has arranged for the inspection of

packing premises and of consignments before dispatch, and the G.W.R. and L.N.E.R. are co-operating in the transport arrangements. As a larger acreage of broccoli is being cultivated in Cornwall this season, there is every prospect, other conditions being favourable, of an increased export trade.

Central Chamber of Agriculture and National Mark Schemes.—

At a meeting of the Council of the Central Chamber of Agriculture, held on November 5, the following resolution was passed :—

“That each Member of this Chamber present shall pledge himself to give an immediate order for *All-English Flour* with *National Mark*, and, where practicable, for *Home-killed Beef* with *National Mark*; that each Member of both Houses of Parliament shall be invited to do the same; that other agricultural organizations of owners, occupiers and workers shall be asked to proceed on the same lines; and that co-operative societies, hospitals, hotels, Boards of Guardians and Army, Navy and Air Force Institutes shall be earnestly requested to give active support to the schemes.”

Marketing Demonstrations.—The following marketing demonstrations were given during the past month :—

Show

Subjects

Birmingham Fat Stock Show. Display of National Mark Beef.

Smithfield Club Show. Pigs and Pig Products, Display of National Mark Beef.

The intention of the graded beef display was partly to familiarize the public with the appearance of National Mark Beef, and partly to secure the interest of retailers.

An illustration of the Birmingham display appears opposite.

Displays of Home Produce.—A Display of Home Produce was exhibited in a “shop window,” built in as part of the Empire Marketing Board Pavilion at the Workers’ Trades and Crafts Exhibition, held at Edinburgh from November 20 to 30. The window occupied a prominent position and provided an attractive setting for the commodities selected for this display—National Mark Flour and National Mark Apples.

An exhibition of Home Produce is also being arranged at the Grocers’ Exhibition, which will be held at Birmingham from the 14th to the 25th of this month (January).



The Display of Graded National Mark Beef at the Birmingham Fat Stock Show, 1929.

WORLD'S POULTRY CONGRESS, 1930

THE World's Poultry Congress, to be held at the Crystal Palace from July 22-30 next, is the fourth of a series of congresses arranged under the general auspices of the World's Poultry Science Association, which was founded by an Englishman, Dr. Edward Brown, who was its first President. This body contains representatives from all parts of the world, and at present its President is Mr. F. C. Elford, of Ottawa. The first Congress was held in 1921 at the Hague, the second at Barcelona, in 1924, and the third at Ottawa in 1927. The number of delegates and the number of visitors attending the Exhibition accompanying the Congress have progressively increased, and at Ottawa there were between 2,500 and 3,000 delegates, while 150,000 people attended the Exhibition. The Ottawa Congress was in fact by far the largest of the series. The Canadian Government spared no effort or expense to ensure its success, and it proved to be the greatest international gathering ever held in that country. The Rt. Hon. Stanley Baldwin, M.P., the late Prime Minister, accompanied H.R.H. the Prince of Wales on a visit to the Congress, and on the occasion of that visit he conveyed an invitation to the Association to hold the next Congress in England. This invitation was accepted.

At the special request of the National Poultry Council, the Ministry of Agriculture and Fisheries, working in conjunction with the Department of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland, was entrusted with the organization of the Congress, and for nearly a year this work has been in progress. A series of committees was set up to deal with various aspects of the Congress and Exhibition. These committees are mainly composed of prominent members of the poultry industry, who are giving voluntary service in the effort to make the Congress an even greater success than its Canadian predecessor. His Majesty the King, Her Majesty the Queen, and H.R.H. the Prince of Wales have graciously consented to act as Patrons of the Congress. The Minister of Agriculture and Fisheries, the Secretary of State for Scotland, and the Minister of Agriculture for Northern Ireland are Presidents. The first Vice-President is Mr. F. C. Elford, President of the World's Poultry Science Association, and other Vice-Presidents are Lord Dewar, Dr. Edward Brown, the President of the National Poultry Council, and the President of the National Farmers' Union. Sir Charles Howell Thomas, Permanent Secretary of the Ministry, is Chairman of

the General Committee. Mr. Percy Francis, O.B.E., the Ministry's Poultry Commissioner, is Director of the Congress.

The invitation to other countries to participate in the Congress, which was issued by the British Government early in 1929, has already been accepted by 45 Governments, exclusive of this country. This fact in itself ensures that the Congress will be more widely representative than any of the previous ones. Moreover, of the 45 countries who are participating, no fewer than 31 have set up National Committees, or their equivalent, for the purpose of organizing their representation at the Congress.

The establishment of a National Committee may be taken to mean that delegates will probably attend the conferences and that, in most cases, national exhibits will be staged and live stock entered in the Congress Exhibition.

Conferences.—The Congress and Exhibition will be divided into various sections. In the first place, there will be conferences at which papers will be read and attendance at which will be limited to members of the Congress. The object of these is to ventilate new knowledge and secure the discussion of problems associated with the poultry and small live stock industries by experts from many countries. The provision of interpreters will ensure that the experience of foreign authorities will be brought to our knowledge by the best possible means, namely, the spoken word. The conferences will embrace every important aspect of poultry husbandry and management, including practice, science and economics. There will be five sessions ~~sitting~~ simultaneously. These sessions will deal respectively with questions relating to (a) Breeding and incubation; (b) Nutrition and rearing; (c) Diseases and their control; (d) Economics, including marketing; (e) Education and general. Probably also a session for papers dealing with rabbits, pigeons, etc., will be arranged.

If any industry is to progress or even maintain its position, it must be constantly on the look-out for new methods and scientific knowledge. This is especially true in the case of such a rapidly developing industry as poultry keeping, where the keenest competition exists to secure the great consuming market of the United Kingdom. During the past decade there has been a very substantial increase in the home production of poultry and eggs, and it has been possible for this increase to be absorbed by the consuming market at prices remunerative to the producer. It does not necessarily follow that development can progress so happily in the future,

There is abundant evidence that European countries, in their process of recovery from the devastating effects of the Great War, are rapidly developing their production of poultry and eggs ; and in several cases countries which have been importers bid fair to become exporters in the near future.

The moral is obvious. The home poultry industry must leave no stone unturned in the direction of improving methods and reducing production costs if it is to maintain and extend its grip on the home market and do so at remunerative prices. Hence the value of the dissemination of the most up-to-date knowledge on problems associated with poultry husbandry.

The Congress Committee responsible for the selection of papers and the organization of discussions is keeping in view two essentials : (1) A severe limitation of papers, to ensure that only the most authoritative and up-to-date knowledge is communicated to the conferences ; (2) The importance of providing information of a kind and in a form likely to be appreciated and used by the practical poultry-keeper. It cannot be expected, of course, that the papers will all be " popular," but it is hoped that the amount of purely scientific material which cannot be properly appreciated by the practical man will be reduced to the minimum.

The Exhibition of Stock.—As already stated, the conferences will be confined to members of the Congress. To the ordinary visitor the appeal of the Congress will lie in the Exhibition. This will be of an international character. Its main object is to arouse national interest in the poultry and small live stock industries, and to increase trade. It is being framed to appeal to the two classes into which the poultryman is accustomed to divide the British public—those who are poultry-keepers and those who are not. Let us try to visualize the Exhibition as a whole and see what the practical poultry-keeper has to learn from it. The references are limited to poultry, but it should be understood that they are intended to embrace other forms of small live stock.

The national exhibits in the north nave will reflect all that is best in the methods of dealing with poultry in the countries concerned. Out of the 31 countries who have set up national committees to organize their representation, it may be assumed that most will be represented *inter alia* by an exhibit in the north nave. Thus, in this comparatively limited area there will be concentrated an ocular demonstration of the poultry industries of the leading countries of the world, backed by graphic illustrations of general national features,

agricultural, historic and scenic. To quote but one example, poultry-keepers will be able to see the methods adopted by other countries to develop their poultry industry in the most remunerative way. This must prove of great educative value, for the British consuming market is one on which not a few countries concentrate their efforts, and the home producer can compete in the struggle for markets with much greater success if he is properly informed of the methods of his principal competitors.

Moreover, among the national exhibits will be the one staged by the Governments of Great Britain and Northern Ireland. This will be of a twofold nature; one section, in the centre transept, dealing with the industry as a whole, and the various educational and research activities which aim at its gradual improvement; the other in the north nave, dealing with the marketing methods in the three countries. A large sum of money is being spent on these two exhibits, and British poultry-keepers should welcome the opportunity of seeing "at a glance" the numerous ramifications of their industry, its progress in recent years, and the various means by which its high reputation for efficiency has been secured and is being maintained.

In the centre transept the Empire Marketing Board will stage a display representing poultry progress within the Empire; the educational section of the United Kingdom national exhibit will be closely associated with this display. The whole of the centre transept will, in fact, be transformed, to make it a fitting "centre" of a great international exhibition.

In the live stock section will be gathered together exhibits representing the best pure-bred stock of many countries. At this early date it is difficult to forecast numbers with any accuracy, but in all probability 8,000 or 10,000 head of poultry will be assembled, together with displays of rabbits and pigeons. One of the most satisfactory features is the great overseas' interest in this section, and the Congress Committee has been assured by representatives of many countries, including Canada, the United States of America, Germany, France, Denmark, Belgium, Roumania and Holland, that representative collections of live stock will be exhibited. As examples of proposals which have already reached the Committee it may be stated that Germany expects to send 1,000 birds, Canada and the United States 500 each, France 200 to 250, Denmark 300, Belgium, Holland and Roumania

100 each. In the aggregate, therefore, the overseas entries of live stock should be a very interesting and instructive feature. It is particularly important that the British entries should be substantial, so that visitors—particularly overseas' representatives—may see the British poultry industry in its proper perspective as the home of the leading pedigree stock of the world. The Congress Committee are assured that home breeders will rise to the occasion and will take this extremely valuable opportunity of demonstrating to all concerned the fact that British poultry have reached the premier position amongst the world's breeds. The importance of providing a stimulus to the British export trade in pedigree poultry has received special consideration. A sales bureau with interpreters in attendance will afford facilities for business with foreign buyers, whilst a public auction sale of live stock exhibits will be conducted during the Congress.

The layout of the live stock section will be planned in such a way as to make the display of real educational value. Each nation will have its own section, and within this section it is proposed that the grouping shall be according to breed. A further sub-division will be that of what may be termed production entries, namely, birds which have secured an officially recognized reputation for egg-producing capacity. This sub-division will, in the British section, provide a means of showing the strength of the movement in favour of increased egg production, sponsored not only by the Ministry through county education authorities, but by the National Poultry Council, the Poultry Club, the Lancashire Utility Poultry Society, the National Utility Poultry Society, and last but not least, the *Daily Mail*. Taken as a whole, therefore, the British section will show (1) the very high level of efficiency reached by home stock, and (2) the channels by which their capacity in egg production is being still further improved.

It is perhaps almost needless to add that the presentation of the live stock section will be on lines worthy of a great international public exhibition. Considerable attention is being given to this important question of decorative effect.

Trade Exhibits.—A further important section of the Congress will be that devoted to trade exhibits, to which the whole of the south nave and the greater part of the first gallery have been allocated. It promises well that all the available space in the south nave has been already applied for, and the Committee concerned is now allocating sites in the gallery. Overseas firms lost no time in applying for sites, and two

or three months ago there seemed danger that British traders might be seen at some disadvantage compared with the strength of the overseas representation in this section. Since then, fortunately, home manufacturers have come forward more strongly, and when the Exhibition opens they will be present in considerable force. The exhibits will in all cases be of such a nature as will interest the poultry industry, and many of the firms are spending large sums on putting up really attractive displays. It can also be said without giving away secrets that the one aim of the Congress Committee, not in regard to this section only, but through the Exhibition as a whole, is to ensure a uniformity of design and layout which will make a refreshing comparison with some, at least, of the exhibitions of an agricultural character to which the British public have been accustomed.

Entertainment.—The poultry keeper will, therefore, have much to learn, and the poultry breeder much to gain, from the Congress Exhibition. The ordinary visitor, not perhaps at present directly interested in poultry, will also find in the exhibition much that is of interest to him, for even if he is not a producer he is certainly a consumer. Perhaps what may be termed the educational side might in itself fail to attract the ordinary visitor in large numbers, and as it is most important in the interests of all concerned that large numbers should attend, the Committee are making arrangements for other attractions which will not only draw people to the Crystal Palace, but will provide means of entertaining the delegates and members. Among these may be mentioned concerts, a military display, fireworks, military bands, and so on. There will also be a Royal opening ceremony, which in itself should give the Congress a very effective "send off."

The final decision as to the success or otherwise of the Congress rests with the British public, and particularly with British poultry keepers. The Congress Committees are doing their part by staging an exhibition which will be on a grander scale than anything of its kind every seen in this country, but it is the public who, by their exhibits and personal attendance, will determine the ultimate result of the Committees' labours. Such an opportunity of extending their trade and raising the prestige of their industry will certainly not recur for poultrymen within this generation.

JANUARY ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),
Agricultural Organizer for Derbyshire.

Review of 1929.—The year just passed will be remembered as one of extremes and abnormalities : it is very unusual for any one year to have memorable frost, heat, drought and floods. The keen frost of February and March, however, was such as had not been experienced for over thirty years. This was followed by a dry thaw and, except for moderate rainfall in May, a continuation of dry conditions lasting until the middle of October. During this period water supplies on many farms failed, pastures burnt up and meadows made little growth, though arable land crops generally resisted the drought remarkably well. During November and the first part of December, very heavy rains fell repeatedly, with the result that there was much flooding in the river valleys.

The late winter frost and dry thaw made an excellent tilth for the root crops, and this condition doubtless played an important part in determining the success of beet, mangolds and potatoes which grew and yielded well in spite of the absence of effective rain during the greater part of the growing season. Even turnips and swedes made nearly average yields. To the same cause may be attributed the success of the oat crop under growing conditions that would have favoured attack of frit fly had the crop been sown late and in less satisfactory soil tilth.

There are various old sayings to the effect that drought does not bring dearth to England. Nowadays, when food and fodder materials are imported from so many parts of the world, there is little risk of serious inconvenience being caused to the British public through adverse climatic conditions in any one country. As regards corn, this year's yields at home seem to support the observation that our soils, which are generally heavier than those elsewhere, stand drought well. It might have been expected, however, that the parched state of our pastures would have occasioned some shortage in the supply of milk and home-fed beef. No appreciable shortage of milk was experienced, however, and prices of beef cattle failed to rise.

Although yields of arable land crops have been good, low prices for the principal selling crops—potatoes and cereals—have made the financial results of this class of farming unsatisfactory. Store cattle have stood at prices little above pre-war values, which fact, though discouraging to the breeder, has

assisted the feeder ; but the prices of fat cattle have been somewhat lower than in 1928, *viz.*, 30 to 36 per cent. above pre-war level, these index figures showing a relatively much smaller increase than those of the retail prices of beef in 1929 over pre-war years. Milk prices for the contract period of 1929-30 were fixed on a somewhat lower scale than those of the preceding year, in spite of the known shortage of winter fodder supplies. The market reports, however, indicate that ample supplies of accommodation milk are available at figures below those of the regular contract deliveries, and this may be largely due to the revival of the pastures in October ; this improvement has also to some extent conserved the hay stacks.

While the year 1928 was certainly a grass-farmers' season, the past year has not favoured either grass or arable farming, although in the matter of production arable cropping has been the more successful. Pigs, especially porkers, and eggs have realized the best prices, and the production of both eggs and pork has been favoured by the low prices prevailing for cereals and their by-products. Both store and fat sheep have maintained high prices compared with cattle, mutton having been dearer than beef, both wholesale and retail.

The Outlook.—So far as pigs and poultry are concerned there does not seem to be much likelihood of any appreciable change in the prospects of the near future. The numbers of pigs were down by 20 per cent. at the last census ; the demand for eggs and pig flesh would be increased by any improvement in trade and industrial conditions ; and feeding stuffs seem likely to be available in sufficient quantities to prevent any serious rise in their cost. Sheep have declined in numbers in two successive years ; and, if the growing preference of the consumer for mutton and lamb continues, the price of this class of meat will be maintained.

As regards beef, the situation is very difficult to weigh up. The numbers of cattle in England and Wales showed a decline in both 1929 and 1928 ; the provisional figures for Ireland showed a slight decline in 1929 compared with the previous year ; imports of meat from Argentina have gradually declined since 1927 and, according to Sir William Haldane, this is likely to continue for some time. In a recent paper read to the Agricultural Education Association, Professor Scott Watson reviewed the position and arrived at a somewhat optimistic conclusion ; he thought that beef

prices would recover within the next two years and that for the succeeding period of six or seven years we should see beef relatively dear—probably ten points above the general agricultural index level. A further conclusion was that the seasonal variation in prices would be still more marked than it has been in recent years. Professor Watson was here referring to an effect of the grassing down policy, which has resulted in an increase in the number of fat cattle marketed in the late summer and autumn months and a smaller supply in the period March to June.

In view of the decline in wheat prices since August, it is of special interest to note that values have begun to ascend. The reason for this and for a more optimistic view of the corn situation is that the world supply of wheat is now back to normal quantities. The subject is specially dealt with in the November Monthly Crop Report and Statistics of the International Institute, which states that the world production in 1929 is notably lower than in the preceding two years. This decrease corresponds to the very large fall in the yields of the exporting countries, and although production reached its highest level in the importing countries, this increase is a relatively small factor, 100 million bushels compared with a fall of 600 million bushels in the output of the former. There was, however, a large accumulation of old stock on August 1, 1929, which will be drawn upon between now and next August. The Institute estimates that the carry-over at the end of the 1929-30 season will be much less than it was last August, less than in 1928, but larger than in the two preceding years. As there is a connexion between the magnitude of supplies and price, it is reasonable to expect that prices in England and Wales of the next crop will average between 11s. 11d. and 10s. 3d. per cwt., which were the average prices for the cereal years 1926-27 and 1927-28 respectively.

January Operations.—One of the most typical field operations of this month is the ploughing of leas for spring corn, the work being commonly deferred till January because the ensuing corn crop will be cleaner than on land ploughed earlier, and also because this is work that is possible at a time when there is not much other occupation for the teams. On light soils the ploughing of sheep folds and any arrears in other ploughing may be done in January, but on heavier lands the plough may have only limited employment, unless an

opportunity occurs to reverse—not cross-cut—the furrows on land intended for roots.

The heavy rains of November and early December interrupted the harvesting of beet and the sowing of wheat after this crop. After January 15 sowing may be resumed at the first proper opportunity. Winter oats, both whites and blacks, as well as hardy varieties of barley, beans and peas may also be sown in this month. The depth of drilling should be shallower than is customary in October, but a watch must be kept to avoid depredations of hungry birds.

Although days are short and the land generally too wet for much field work at this season, much can be done by way of preparation for the busier period ahead. Spring seed corn should be winnowed in readiness for February and March ; seeds and fertilizers should be ordered ; the harrows, cultivators and horse-hoes should be looked over and put into condition ; and an opportunity may be found to overhaul other machinery and tackle, including harness. Hedge-laying, draining, water-furrowing and road mending are other winter jobs ; but special mention must be made of the boxing of seed potatoes, not only as a preparation for planting, but as a means of ensuring a heavier crop and a better sample of ware. Frosty periods in January are appreciated when a wet December has hindered manure carting, but attention must not be confined to the solid manure ; the liquid can be applied with advantage to all kinds of grass land, especially if helped with slag.

Live Stock.—After Christmas young cattle are either brought indoors, or, if wintered out, given fodder in addition to what they can gather by grazing. As mentioned on previous occasions, young cattle growing through the winter make more rapid gains in the following six months if not too well fed at this time of the year. A more liberal diet would be justified where the object was to fatten the cattle off early in the summer ; but in other circumstances nothing better than a supply of long fodder is needed. Indeed, there is reason to believe that good straw may have a higher value for this purpose than it has when fed to fattening or other stock that are warmly housed and are getting a ration of a heat-producing nature.

Calves born in the dark winter months, when milk is neither so abundant nor so rich in vitamins as it is when the cows are at grass, should receive special consideration. The ordinary

milk substitutes, such as a mixture of equal parts linseed cake, crushed oats and palm kernel cake, are deficient both in vitamins and essential minerals. The latter can be supplied in the form of meat and bone meal, which may take the place of part of the cake as the source of protein; and the former may be added by giving about an ounce of cod liver oil per head per day. This quantity may be mixed with the concentrates at the rate of half a pint per 28 lb. of meals.

Although many farmers have proved the benefits of improved methods of pig feeding, there are still too many who do not realize how much more rapidly pigs can be made to grow and fatten by feeding a suitable allowance of protein-rich food such as meat and bone meal, which supplies essential minerals as well as protein. Too commonly, also, the winter ration is fed in an excessively watery form, with the result that the difference between the progress made in winter and in summer is much greater than can be accounted for by mere seasonal conditions. The ideal is undoubtedly to feed a thick slop, giving the pig the opportunity to drink such additional water as it may need.

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NOTES ON MANURES

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Cultivation.—It is believed by farmers that thorough cultivation is an aid to the action of manures. No doubt soil conditions generally are made highly favourable to growth and the plant can then utilize added nutrients to the full. The great benefit of cultivation in increasing the productivity of land is well brought out by an examination of the results of the cropping of Broadbalk Field at Rothamsted before and after two years of very thorough fallowing operations in 1926 and 1927. These operations were undertaken to get rid of the weeds which had become very prevalent under continuous wheat culture for a long period of years, but it can hardly be claimed that the entire benefit resulting from the fallow was to be attributed to the greater cleanliness of the seed bed. The greatest proportional benefit in fact was observed on plots which were almost too poor to grow weeds. The results are given in the table at the top of the following page. The nature of the season was not the chief factor concerned in this result, for the yield of wheat grown under ordinary

CONTINUOUS WHEAT: YIELD PER ACRE

Yearly treatment	1928		Average 1916-1925		Average 1852-1928	
	After two years fallow					
	Grain	Straw	Grain	Straw	Grain	Straw
	Bus.	Cwt.	Bus.	Cwt.	Bus.	Cwt.
No manure ..	27.9	27.8	7.6	6.9	11.8	9.9
Farmyard manure	48.4	32.0	22.5	29.2	33.2	34.5
Complete artificials	55.2	61.4	21.4	24.8	29.2	30.8

conditions was only slightly better in 1928 than in the ten year period 1916-1925, as the following figures show:—

	Yield of wheat	
	1928	Bushel per acre Av. 1916-1925
Rothamsted non-experimental fields ..	30.2	28.4
Hertfordshire	32.1	30.2
England	34.0	32.1

The most striking result was that the yield on the land which had received no manure since 1839 was increased $3\frac{1}{2}$ -fold by the fallowing operations, raised, in fact, to the level of ordinary farm cropping on this class of land. The crop on land receiving generous dressings of farmyard manure was more than doubled, while that on land receiving ample plant food as artificials was increased $2\frac{1}{2}$ times. A further feature of the experiment was that even the heaviest crops of wheat stood up well to harvest. It appears, therefore, that there are benefits arising from thorough cultivation which are as yet unexplained. They operate alike on land originally poor in plant food and land with an abundant reserve.

Striking benefit has been observed from fallowing unmanured land under glass-house conditions, but not to the same extent where the crop was manured. Thus at Cheshunt the following yields were obtained with tomatoes:—

		TONS PER ACRE			
		Manured each year		Unmanured each year	
		Cropped	Fallow	Cropped	Fallow
		section	section	section	section
1923		55.8	—	32.3	—
1924		52.3	55.2	25.5	46.4

Manuring of Fruit Trees.—In recent years the balance of the fertilizer treatment usually given to fruit trees has been called into question in connexion with a trouble known as "leaf scorch." This consists of a browning of the edge of the leaves, and is associated with general unthriftness and

lack of vigour in the trees. These symptoms have been shown to be related to deficiency of potash and excess of nitrogen. In ordinary practice dung, bones, shoddy, guano, and other organic manures are used for fruit—broadly speaking, materials which are relatively rich in nitrogen and phosphate but poor in potash. Dung is the most balanced of these, but even in this case the potash may be insufficient unless plenty of litter is used and the manure is carefully stored. If such manures are consistently employed on soils naturally short of potash, leaf scorch is likely to occur, as has been demonstrated at Long Ashton and elsewhere. Redressing the balance of the manure by generous potash treatment will usually remedy this in a few seasons. Three or four hundredweight per acre is the dressing recommended.

It is noteworthy that the nitrogen-potash ratio affects the vigour and disease resistance of most crops. With tomatoes, for example, a high proportion of nitrogen to potash favours the incidence of leaf stripe, which is controlled when the potash is increased. On the permanent mangold field at Rothamsted the foliage of plots receiving very heavy nitrogenous dressings show in the absence of potash a dying off of the margins of the leaves very similar in general habit to the leaf scorch of fruit trees. This occurs even where dung is applied, the potash of the dung being insufficient to counteract the disease. The addition of potash salts completely overcomes this, and forms a very striking demonstration of the above effects. In certain seasons the leaves of potatoes have been observed to bear similar abnormalities, which also disappear when the nitrogen-potash balance is restored. Where liberal use is made of nitrogenous fertilizers the need for potash is therefore increased.

Artificial Farmyard Manure.—This material has frequently been mentioned in this JOURNAL. A full account of the principles underlying its production was published in Vol. XXVIII, August, 1921, p. 398. The process, in brief, is to supply enough nitrogen and phosphatic compounds to straw and other waste cellulose material to enable the micro-organisms which are always present to break down the easily decomposable organic matter of the straw—the sugars, starches, and pentosans—leaving the more resistant residues in a humified condition. The final product resembles farmyard manure in its chemical composition and physical properties. To achieve this result moisture is absolutely necessary, and the reaction of the mass must be maintained neutral. A reagent called Adco is obtain-

able to provide the necessary chemicals. The water must be supplied artificially, although recent trials have shown that the judicious use of the winter rainfall can materially reduce the need for watering. Up to the present the treating of straw with chemicals and water has been a manual operation. A new machine has now been devised for wetting the straw and applying the reagent in a continuous operation at thrashing time. Such a machine was recently demonstrated in work on Lord Iveagh's estate at Elvedon. As thrashing proceeds the straw enters a chaff-cutter of large capacity adjusted to cut 6-inch lengths. The cut straw then passes to an elevator and during its passage it is sprayed with water pumped from a neighbouring pond, and is sprinkled with the correct quantity of reagent from a hopper. The treated straw is deposited on a stack, which is built up in the ordinary way eventually to become a clamp of artificial farmyard manure. The staff required is one man in excess of the usual labour for thrashing and building a straw stack. To obtain a satisfactory product it is necessary to add further water from time to time and to turn the heap once when about a month old.

Where straw is plentiful and live stock is unprofitable the above process may have a future.

Dung for Meadows.—Arable farmers will not, as a rule, have farmyard manure to spare for their grass land; but those whose holdings are largely in grass will usually be able to do so. Dung is an excellent manure for hay production. It supplies nitrogen and potash in sufficient quantities, but is relatively poor in phosphoric acid. Consequently it tends to produce quantity rather than quality. This can be remedied by supplementing the manure with a separate dressing of basic slag or finely ground North African rock phosphate, these manures encouraging clovers and finer grasses. A further effect of dung on grass land is the production of early grazing before shutting up for hay, the shelter provided by the surface dressing and the nitrogenous effect probably being responsible for this. An application of ten tons of dung together with basic slag providing about 100 lb. of phosphoric acid (i.e. from 6 to 10 cwt. according to grade), every three years, has been found satisfactory.

PRICES OF ARTIFICIAL MANURES

Average prices per ton during week
ended December 11.

Description	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	9 17d	9 17d	9 17d	9 17d	12 9
Nitro-chalk (N. 15½%) ..	9 19d	9 19d	9 19d	9 19d	12 10
Sulphate of ammonia:—					
Neutral (N. 20·6%) ..	9 17d	9 17d	9 17d	9 17d	9 7
Calcium cyanamide (N. 20·6%)	8 19e	8 19e	8 19e	8 19e	8 8
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%) ..	..	10 10h	..	..	..
Kainit (Pot. 14%) ..	3 5	2 19	2 18	3 2	4 5
Potash salts (Pot. 30%) ..	5 2	4 17	4 18	4 17	3 3
" (Pot. 20%) ..	3 14	3 8	3 7	3 10	3 6
Muriate of potash (Pot. 50%)	9 14	9 0	8 19	9 2	3 8
Sulphate, " (Pot. 48%)	11 15	11 2	11 1	11 2	4 7
Basic Slag (P.A. 15½%)||	2 13c	2 3c	..	2 9c	3 1
" (P.A. 14%)||	2 7c	1 16c	1 16c	2 3c	3 2
" (P.A. 11%)||	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 20·27½%) ..	2 10||	2 7||	..	2 5a	1 8
Superphosphate (S.P.A. 16%)..	3 11	..	3 6	3 6	4 2
" (S.P.A. 13½%)..	3 5	2 18	3 0	3 0	4 4
Bone meal (N. 3½%, P.A. 20½%)	8 15	8 10	8 12	8 2	..
Steamed bone flour (N. ¾%, P.A. 27½-29½%) ..	5 17b	..	6 10	5 2	..
Burnt Lump Lime ..	1 8k	1 10l	1 11n	2 2m	..
Ground Lime ..	1 12k	..	..	1 17m	..
" Limestone ..	1 3k	..	1 8n	2 6m	..
" Chalk ..	..	1 6	..	1 11m	..
Slaked Lime ..	..	..	2 12n	3 2m	..

Abbreviations: N.=Nitrogen; P.A.=Phosphoric Acid; S.P.A.=Soluble Phosphoric Acid; Pot.=Potash.

* Prices are for not less than 6 ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 80% through standard sieve. α. 85% through standard sieve.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f F.o.r. Gooise.

g 6-ton lots f.o.r. Bristol: ground limestone 98·95% through standard sieve.

h F.o.r. Knottingley.

m 6-ton lots delivered London district, ground limestone 65% through standard sieve. Ground limestone, ground chalk and slaked lime in non-returnable bags.

n 6-ton lots delivered Liverpool stations, ground limestone 45% through standard sieve. Ground limestone and slaked lime in non-returnable bags.

NOTES ON FEEDING STUFFS

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Fats and Carbohydrates.—The functions carried out by fats and carbohydrates (including fibre) in the body are to a large extent interchangeable: this is a fundamental difference between these two classes of nutrients and proteins, the latter having a special part to play in repairing tissues, etc., which they alone are able to perform. Fats and carbohydrates consist only of carbon, hydrogen and oxygen, and though the proportions of these are very different in the two groups, as is the manner in which they are combined (which gives them very different chemical properties), we know that the body is able to convert one into the other—at least it is definitely certain that the body can convert carbohydrates into fat, and does so on a large scale, but there is some doubt whether it can carry out the reverse process.

Fats are pre-eminently suitable for storage, as they contain a maximum of energy in a minimum of weight. If the three classes of nutrients are burnt we find that they give out the following relative amounts of heat per unit of weight :—

Fats	..	..	..	9.3
Proteins	..	..	..	5.8
Carbohydrates	..	..	..	4.1

In the animal body the fats have an even greater relative heat output than the figures suggest, for the body is able to extract the full heat value from them, but is not capable of doing so from proteins and carbohydrates. In the case of proteins the nitrogenous part cannot be used for energy, but is excreted in the urine as urea, and if we subtract the heat equivalent of this "ash" of protein, it reduces its value to 4.7. With carbohydrates, fermentative processes occur in the stomach and intestines, in which bacteria break down a certain portion (estimated at 8 per cent.) to marsh gas, which escapes from the body and so produces no energy in it; making allowance for this the relative value of carbohydrates is reduced to 3.8.

Fat is, then, a very good means of storing up energy in a time of plenty, against any time of shortage which may occur in the future. If such an occasion arises the body can use this reserve supply to provide energy to keep itself going, but, of course, it is useless to make good any deficiencies in

protein, since it contains no nitrogen. Thus the body runs a deposit account in the bank of life, and what it pays into this account is fat.

There are always calls for energy in the living animal, to keep its temperature constant and for the necessary operations of digestion, breathing, etc., in addition to whatever activities are carried out. It must, therefore, have a supply at short call, and so it runs a current account, and for this it uses carbohydrates. If the intake at any time is more than enough to meet the demands made for energy, it tends to accumulate in the current account; but the body does not allow this to go on to any extent, for it converts the surplus carbohydrates into fat—that is, it transfers the excess in the current account to the deposit account, not in the hope of getting any interest, but simply because that is the most convenient way to store it in a small space.

This view of the way in which the body manages its energy supplies is now well established by scientists, but it has not always been accepted. The former conception was that, as movement is carried out by muscles which are composed of protein, it must be the protein in the ration which provides the energy, but this has been disproved, for it is possible to determine how much protein is used up, since its “ash” appears in the urine. Two experimenters tried an experiment on themselves: they climbed a mountain in the Alps and measured the amount of nitrogen in their urine, and found that the protein from which it came could not possibly have provided the energy they had exerted in raising their bodies. Protein is not, therefore, the normal provider of energy, although if it is being eaten in excess of the requirements for repairs of tissue, and for any form of production (the addition of fresh muscle in growing animals, or the proteins in milk), that which is not needed by the body is “burnt” to give energy; this, however, is a very wasteful process, because there is a large “ash” which cannot be used, and also because proteins are the most expensive type of nutrients.

By comparative slaughter experiments Lawes and Gilbert definitely proved that animals form fat from carbohydrates. In this method of inquiry a uniform lot of animals are got together and two or three are selected as being just about the average of the group, and these are killed and analysed. In this way a good estimate is obtained of how much fat is included in the bodies of the others at the beginning of the experiment. The remainder are then fed for as long as required,

and killed and analysed in the same way; the difference between the fat actually found on them and the estimated amount at the start gives the quantity they have put on during the feeding time. Lawes and Gilbert found that this difference was much larger than the total amount of fat they had consumed, and must have come from the carbohydrates in the ration. In this way they demonstrated with scientific certainty a fact which accords with the common observation, that animals can be fattened on carbohydrate foods such as cereals and roots. Professor Hansen in Sweden has also shown that the fat produced in milk can be, and usually is, built up from carbohydrates in the food.

Not all of the fat added to the body or produced in milk comes from carbohydrates, however, for the food consumed usually contains a certain amount, which is used by the body in that form. The ration, however, must not contain too much oil, as this has a detrimental effect on the appetite and on digestion. Kellner recommends that the fat in the ration should not exceed 1 lb. per 1,000 lb. live weight with herbivorous animals, though young stock can deal efficiently with rather more. There are many kinds of fats, and there are wide differences between those occurring in nature; they vary all the way from the fluid oils up to firm substances like mutton fat. During the digestive processes fats are broken down to simpler bodies (fatty acids and glycerine), and are absorbed through the gut wall in this form; during their passage through this wall they are recombined in the proportions necessary to form the fat characteristic of the animal, and it is in this state that they enter the circulatory system. In this conversion of the food fat into body fat there is bound to be a certain wastage, for some particular fatty acid may be contained in much greater proportion in the food fat than in the body fat. It follows that fats, like proteins, have a "biological value," though we have little knowledge what that value is for the various fats; the question is rather of academic than of practical importance, since surplus fatty acids are probably used up as energy producers and so are not wasted. Experiments have shown that there is a 50-65 per cent. efficiency in converting food fats to body fats, varying with the type of food and with the type of animal.

The power of the body to convert one type of fat in the food into another type in the fat it adds to itself, or in the milk it produces, is limited; this has been clearly demonstrated in dogs, which normally have a very firm fat, but which will

store up a fat that is quite fluid if they are fed large quantities of linseed oil. The question assumes some importance in pigs, for the chemical nature of the fat put on, and consequently the commercial value of the bacon, may be affected very considerably by the diet during fattening; in general the fat in the ration should be kept fairly low to avoid these effects. Barley meal and whey tend to give a firm fat, whilst rice meal and oily foods like linseed tend to produce a soft oily fat. Similarly with cattle, grass and linseed cake tend to give a soft fat, whilst roots, starchy foods and cotton cake tend to make it hard.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	7 14
Maize	81	6.8	7 11
Decorticated ground nut cake	73	41.0	12 0
„ cotton cake	71	34.0	11 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1.90 shillings, and per unit protein equivalent, 2.75 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The “food values” which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	8 3
Oats	60	7.6	6 15
Barley	71	6.2	7 12
Potatoes	18	0.6	1 16
Swedes	7	0.7	0 15
Mangolds	7	0.4	0 14
Beans	66	20.0	9 0
Good meadow hay	37	4.6	4 3
Good oat straw	20	0.9	2 0
Good clover hay	38	7.0	4 11
Vetch and Oat silage	13	1.6	1 9
Barley Straw	23	0.7	2 6
Wheat straw	13	0.1	1 5
Bean straw	23	1.7	2 8

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Price per lb. starch equiv.	Pro- tein equiv. %
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.		
Wheat, British..	—	—	9 17	0 12	9 5	72	2 7	1-38	9-6	
Barley, British feeding	—	—	7 10	0 9	7 1	71	2 0	1-07	6-2	
" Canadian feed ..	28 9	400	8 2½	0 9	7 13	71	2 2	1-16	6-2	
" American ..	27 3	"	7 13	0 9	7 4	71	2 0	1-07	6-2	
" Danubian ..	28 3	"	7 18	0 9	7 9	71	2 1	1-12	6-2	
" Persian ..	27 3	"	7 13*	0 9	7 4	71	2 0	1-07	6-2	
" Tunisian ..	28 3	"	7 7†	0 9	6 18	71	1 11	1-03	6-2	
Oats, English, white ..	—	—	7 10	0 10	7 0	60	2 4	1-25	7-6	
" " black and grey	—	—	8 5*	0 10	7 15	60	2 7	1-38	7-6	
" Canadian No. 2 feed	24 3	320	8 10*	0 10	8 0	60	2 8	1-43	7-6	
" mixed ..	19 0	"	6 13*	0 10	6 3	60	2 1	1-12	7-6	
" Argentine ..	21 0	"	7 7	0 10	6 17	60	2 3	1-20	7-6	
" Chilean ..	21 6	"	7 10	0 10	7 0	60	2 4	1-25	7-6	
" German ..	23 6	"	8 5	0 10	7 15	60	2 7	1-38	7-6	
Maize, Argentine ..	32 0	480	7 10	0 9	7 1	81	1 9	0-94	6-8	
" South African ..	33 0	"	7 13†	0 9	7 4	81	1 9	0-94	6-8	
Beans, English winter	—	—	9 10†	1 4	8 6	66	2 6	1-34	20	
" Chinese ..	—	—	9 15‡	1 4	8 11	66	2 7	1-38	20	
Peas, English blue ..	—	—	10 2†	1 1	9 1	69	2 7	1-38	18	
" Japanese ..	—	—	18 10‡	1 1	17 9	69	5 1	2-72	18	
Dari ..	—	—	8 15†	0 11	8 4	74	2 3	1-20	7-2	
Millers' offals—										
Bran, British..	—	—	6 10	1 1	5 9	42	2 7	1-38	10	
" broad ..	—	—	7 2	1 1	6 1	42	2 11	1-56	10	
Middlings, fine, imported	—	—	7 7	0 17	6 10	69	1 11	1-03	12	
" coarse, British	—	—	6 12	0 17	5 15	58	2 0	1-07	11	
Pollards, imported ..	—	—	6 2	1 1	5 1	60	1 8	0-89	11	
Meal, barley ..	—	—	9 2	0 9	8 13	71	2 5	1-29	6-2	
" maize ..	—	—	9 5	0 9	8 16	81	2 2	1-16	6-8	
" " South African ..	—	—	8 15	0 9	8 6	81	2 1	1-12	6-8	
" " germ ..	—	—	9 0	0 15	8 5	85	1 11	1-03	10	
" locust bean ..	—	—	9 5	0 7	8 18	71	2 6	1-34	3-6	
" bean ..	—	—	12 5	1 4	11 1	66	3 4	1-78	20	
" fish ..	—	—	19 0	3 4	15 16	53	6 0	3-21	48	
Maize, cooked flaked ..	—	—	10 10	0 9	10 1	83	2 5	1-29	8-6	
" gluten feed ..	—	—	9 15	0 19	8 16	76	2 4	1-25	19	
Linseed cake, English, 12% oil	—	—	13 15	1 8	12 7	74	3 4	1-78	25	
" " " 9% "	—	—	13 3	1 8	11 17	74	3 2	1-70	25	
" " " 8% "	—	—	13 0	1 8	11 12	74	3 2	1-70	25	
Soya bean " 5½% "	—	—	11 5†	1 19	9 6	69	2 9	1-47	36	
Cottonseed cake—										
English, 4½% "	—	—	7 2	1 7	5 15	42	2 9	1-47	17	
" Egyptian, 4½% "	—	—	6 15	1 7	5 8	42	2 7	1-38	17	
Coconut cake, 6% oil ..	—	—	10 15	1 4	9 11	79	2 5	1-29	16	
Ground-nut cake, 6-7% oil ..	—	—	9 10†	1 6	8 4	57	2 11	1-56	27	
Decorticated ground-nut cake, 6-7% oil	—	—	12 0†	2 0	10 0	73	2 9	1-47	41	
Palm kernel cake, 4½-5½% "	—	—	9 10†	0 17	8 13	75	2 4	1-25	17	
" " " meal, 4½% "	—	—	10 0†	0 17	9 3	75	2 5	1-29	17	
" " " meal 1-2% oil ..	—	—	8 15†	0 17	7 18	71	2 3	1-20	17	
Feeding treacle ..	—	—	6 7	0 9	5 18	51	2 4	1-25	2-7	
Brewers' grains, dried ale ..	—	—	8 5	0 17	7 8	48	3 1	1-65	13	
" " " porter ..	—	—	7 15	0 17	6 18	48	2 11	1-56	13	
Malt culms ..	—	—	8 10‡	1 6	7 4	43	3 4	1-78	16	

* At Bristol.

† At Hull.

‡ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of November and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. Dividing this figure by 7½, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is £s. 8d. Dividing this again by 22-4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1-43d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 8s. 8d.; P₂O₅, 8s. 6d.; K₂O, 8s. 3d.

The effects of food fats can be most readily seen in milking cows, where particularly fatty acids contained in large quantities in the ration can be traced to the milk, with, sometimes, very undesirable results; the larger the proportion of any fat in the food the more will it tend to dominate the milk fat. It is important to notice that the addition of fat to a cow's ration does not tend to raise the fat percentage of her milk—in fact, quite the reverse. Investigations by Golding at Reading have shown that the addition of more than 4 to 6 oz. of cod liver oil to the ration lowers not only the fat percentage but even the total quantity of butterfat produced. When experimenting on the vitamin content of the milk he found that small additions of cod liver oil to the food during winter increased the vitamin content of the milk ten-fold—up to its summer value. At the present time milk is not sold according to its vitamin content, and farmers would not relish the remote prospect of being held responsible for this, as well as the fat and other solids content, and the cleanliness of their milk. Nevertheless, the question of keeping up the richness in vitamins during the winter is worthy of some thought, as this is one of the specially valuable properties of milk, and any business must ultimately benefit if its produce is economically improved.

* * * * *

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1929

Produce of Crops.—The yields of the harvest of 1929 were, with a few exceptions, most satisfactory. All corn crops except beans yielded more per acre than in 1928, and well above the ten years' average, and notwithstanding decreases of acreage in some instances the total production of the various crops was in most cases either greater than or almost equal to that in 1928. Potatoes gave a yield per acre over average, although slightly lower than that of last year. The total production is somewhat higher, owing to an increased acreage. The yield per acre of turnips and swedes was below both the ten years' average and the previous year's yield, and the total production, therefore, was substantially less than in 1928. The yield of mangolds, although slightly above average, was less than in 1928, and the total production was consequently lower.

The yield of both seeds and meadow hay was appreciably below average, but the quality of the crop was good.

PRELIMINARY STATEMENT SHOWING THE ESTIMATED TOTAL PRODUCE AND YIELD PER ACRE OF THE CORN, HAY AND ROOT CROPS IN ENGLAND AND WALES IN 1929, WITH COMPARISONS FOR 1928, AND THE AVERAGE YIELD PER ACRE OF THE TEN YEARS 1919-28.

Crops	Estimated Total Produce		Acreage		Estimated Yield per Acre		
	1929	1928	1929	1928	1929	1928	Average of the ten years, 1919-28
	Thou- sands of cwt.	Thou- sands of cwt.	Acres	Acres	Cwt.	Cwt.	Cwt.
Wheat ..	25,425	25,319	1,330,122	1,395,529	19·1	18·1	17·3
Barley ..	19,951	20,377	1,120,247	1,184,981	17·8	17·2	15·2
Oats ..	30,640	28,862	1,853,790	1,762,410	16·5	16·4	14·1
Mixed Corn	2,323	1,905	138,592	118,243	16·8	16·1	14·5
Beans ..	2,201	2,610	144,435	157,502	15·2	16·6	16·2
Peas ..	1,281	1,100	78,635	69,288	16·3	15·9	14·0
	Thou- sands of tons	Thou- sands of tons					
Seeds Hay*	1,746	2,142	1,523,692	1,567,943	22·9	27·3	27·8
Meadow Hay† ..	3,595	4,276	4,695,916	4,500,163	15·3	19·0	20·3
Potatoes ..	3,588	3,513	518,813	489,019	8·9	7·2	6·1
Turnips & Swedes ..	8,304	9,953	697,878	720,215	11·9	13·8	12·5
Mangolds ..	5,687	5,755	298,690	297,633	19·0	19·3	18·8

* Hay from Clover, Sainfoin, and Grasses under rotation.

† Hay from Permanent Grass.

Corn Crops.—WHEAT.—Notwithstanding a decrease of nearly 66,000 acres, or 4·7 per cent. in the acreage under wheat, the estimated total production is slightly higher than in 1928, being 25,425,000 cwt., an increase of 106,000 cwt. The yield per acre is estimated to be 19·1 cwt., or 1 cwt. more than in 1928, and 1·8 cwt. above the ten years' average. Over-average yields per acre were shown by almost every county except in the North-Western division. The greatest improvements were shown in East Suffolk, which returned 5·1 cwt. per acre above average, and in Lincs (Holland), which showed an increase over average of 3·7 cwt. per acre.

BARLEY.—There was a decrease of about 65,000 acres, or 5·5 per cent., in the area under barley, but an improvement

in the yield per acre compensated to some extent in the total production which is estimated at 19,951,000 cwt., or 426,000 cwt. less than in 1928. The yield per acre is estimated at 17·8 cwt. or three-fifths cwt. higher than in 1928, and 2½th cwt. above the ten years' average. Yields in Norfolk and East Suffolk were 3·3 cwt. and 4·9 cwt. respectively over average, and only two counties failed to secure over average yields.

OATS.—An increase of 5 per cent. in the acreage under oats, together with a very slightly higher yield per acre, combined to give a total production estimated at 30,640,000 cwt., or 1,778,000 cwt. more than in 1928. The estimated yield per acre is 16·5 cwt., compared with 16·4 cwt. in 1928, and the ten years' average of 14·1 cwt. Over average yields were obtained in all but three counties, the greatest improvements being in the South-Western division with 4·7 cwt. per acre above average, and in North Wales with 4·5 cwt. per acre above average.

MIXED CORN.—There was an increase of 17 per cent. in the acreage under mixed corn as compared with 1928, and the yield per acre was 16·8 cwt., or 0·7 cwt. more than in 1928, and 2·3 cwt. above the ten years' average. The total production is estimated at 2,323,000 cwt., or 418,000 cwt. more than in 1928.

BEANS.—The yield of beans harvested as corn is estimated to have been 15·2 cwt. per acre, which is 1·4 cwt. less than in 1928 and 1 cwt. below average. This lower yield was taken from a smaller acreage than in 1928, and the total production, which is estimated at 2,201,000 cwt., is consequently lower by 409,000 cwt.

PEAS.—The total production of peas harvested as corn is estimated at 1,281,000 cwt., or 181,000 cwt. more than in 1928. This increase is due to a larger acreage and also to an improved yield per acre which was estimated at 16·3 cwt. compared with 15·9 cwt. in 1928, and a ten years' average of 14 cwt.

Hay.—Weather conditions during the season were unfavourable to the hay crop, which as regards both seeds and meadow hay shows a considerable fall from the ten years' average. The reduction in the yields per acre was very general throughout the country, but was less marked in the areas of the North, Wales, and South-West which were hardly affected by the unusual drought.

SEEDS HAY.—The estimated yield per acre of seeds hay is 22·9 cwt., which is practically 5 cwt. per acre below average,

and about $4\frac{1}{2}$ cwt. per acre less than in 1928. The acreage was also lower than in the preceding year, and the total production is consequently substantially lower, being 1,746,000 tons, as compared with 2,142,000 tons in 1928. Only six counties secured over average crops of seeds hay.

MEADOW HAY.—Although the acreage from which meadow hay was taken was over 4 per cent. larger, the total production estimated at 3,595,000 tons was appreciably less than the 4,276,000 tons cut in 1928. This reduction is due to the poor yield per acre, which is estimated at 15·3 cwt., as compared with 19 cwt. in 1928, and a ten years' average of 20·3 cwt. Only two counties, both in Wales, secured over average crops.

Potatoes.—The yield per acre of potatoes is estimated at 6·9 tons which, although four-fifths ton above the ten years' average, was about $\frac{1}{3}$ rd ton lower than the record yield of 1928. There was, however, an increase in the acreage, and the resulting total production is consequently higher than the heavy crop of last year, being estimated at 3,588,000 tons, as compared with 3,513,000 tons in 1928. The best average yields per acre were obtained in Norfolk, where the average of 9·9 tons was 2·6 tons per acre above the average for the county, and in the Isle of Ely, where the yield of 8·1 tons per acre was 1·5 tons above the county average.

Roots.—**TURNIPS AND SWEDES.**—A reduced acreage under turnips and swedes, and a lower yield per acre, as compared with 1928, resulted in a total production which is estimated at 8,304,000 tons, or 1,649,000 tons less than in the previous year. The yield per acre is estimated at 11·9 tons, compared with 13·8 tons in 1928, and a ten-year average of 12·5 tons. Under average yields per acre were returned in all divisions except the South-Western, Northern and North-Western, and in Wales, where the majority of counties returned yields per acre above average.

MANGOLDS.—The production of mangolds varied little from that of 1928. A small increase in acreage was set off by a slight reduction in the yield per acre, and the total production, which is estimated at 5,687,000 tons, is 68,000 tons less than in 1928. The yield per acre is estimated at 19 tons, or 0·2 tons above average and ·3 tons less than in the previous year. The yields per acre of mangolds showed considerable variation. About one-third of the counties obtained under average yields, and these were practically confined to the Eastern, North-Eastern, South-Eastern and East Midland divisions.

SUGAR BEET.—The acreage under sugar beet this year

showed a marked increase of 31 per cent. over that of 1928, and was the largest on record under this crop. So far as can be estimated at present the yield per acre of washed and topped roots is likely to be about 8 tons or about the same as last year, while it is anticipated that the total production will be about 1,860,000 tons. The crop is generally reported to be satisfactory in regard to quality and sugar content.

* * * * *

MISCELLANEOUS NOTES

THE Ministry has received, through diplomatic channels, the following translation of particulars furnished by the Asociacion General de Ganaderos (General Society of **Essay Competition** Cattle Breeders of Spain) in respect of an essay competition promoted by the Asociacion.

The General Society of Cattle Breeders have decided to hold an essay competition on the following subjects :—

Theme 1 : Contribution to the study of the increase of forage supplies in dry regions in thinly populated districts.

First prize : 1,000 pesetas* and 1st Medal.

Second prize : 300 pesetas and 2nd Medal.

Theme 2 : Influence of vitaminic factors in feeding, giving particulars ascertained from the writers' own experience.

First prize : 2,000 pesetas and 1st Medal.

Second prize : 500 pesetas and 2nd Medal.

Theme 3 : Present position of information regarding epizootic abortion. Scheme of work and methods necessary for investigating this complaint. Means of ensuring efficacy of sera and vaccines and avoiding vaccination accidents and compensating breeders for losses in experimentation in the event of there being any such accidents.

First prize : 2,000 pesetas and 1st Medal.

Second prize : 500 pesetas and 2nd Medal.

It is not necessary to develop both parts of the foregoing theme. It will be sufficient if the writer devotes his attention to one of them.

* The value of the peseta at par is 9.516d., or 25.22½ to the British pound, but the current (December) exchange rate is, approximately, 35 pesetas to the pound.

Theme 4 : Supply of milk in large towns. Methods of effecting this service under the best conditions for producer and consumer.

First prize : 1,000 pesetas. **Second prize :** 300 pesetas.

Themes 2 and 3 are of an international character and investigators of all countries may transmit scientific works in their own language, although, in order to facilitate reading and interpretation, it would be preferable to send them in Spanish, French or English.

The works are to be original and those which gain prizes will remain the property of the Society. If published by the Society 200 copies will be supplied to the author.

Essays are to be transmitted in sealed and registered envelopes before April 1, 1930, to the Asociacion General de Ganaderos, Huertas 30, Madrid, Spain. Each essay submitted is to bear a title (lema) or nom-de-plume. A separate, sealed envelope, with the same title or nom-de-plume written thereon and containing a card or slip bearing the name and address of the writer, should be enclosed with the essay.

* * * * *

THE Institute has recently published the International Year Book of Agricultural Statistics for 1928-29. The new volume brings up to date the information provided in previous issues, while the particulars have been amplified in some directions, notably by the inclusion of statistics of the international trade in certain descriptions of meat.

**International
Institute of
Agriculture**

The general structure of the volume is substantially the same as in earlier years. The statistics presented are grouped under nine main sections, the salient features of which are summarized in the introduction. The first section deals with the area and population of each country of the world, while in section two the latest information is given as to the apportionment of the total area, the agricultural production and the numbers of live stock in 49 countries. Section three is devoted to the world production of 36 crops and section four to the numbers of the principal descriptions of live stock. The remaining sections deal with international trade, prices, ocean rates of freight, fertilizers and rates of exchange. In each section the statistics generally cover the past three or four years with a pre-war comparison.

Copies of the latest volume, which as will be seen contains a most extensive range of agricultural statistics, may be purchased from the Ministry (price 20s. in paper covers).

NUMBER and declared value of animals, living for breeding, exported from Great Britain and Northern Ireland in the three months ended September, 1929, compared with the corresponding period of 1928. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	July to Sept., 1929		July to Sept., 1928	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	22	3,550	35	5,204
Brazil	12	969	15	2,765
Chile	1	945	2	468
Colombia	0	0	10	241
Uruguay	13	3,500	11	1,400
Australia.. ..	15	3,118	0	0
Canada	175	15,351	128	5,975
Irish Free State..	531	11,827	362	7,490
Kenya	12	571	0	0
Southern Rhodesia ..	28	1,857	1	450
Union South Africa ..	2	85	19	1,712
Other countries ..	18	560	9	331
Total	829	42,333	592	26,036
SHEEP AND LAMBS				
Argentina	166	4,140	96	2,211
Brazil	50	1,583	19	1,488
Chile	59	2,745	47	1,234
France	147	1,500	0	0
Russia	0	0	502	5,171
Uruguay	78	2,361	68	1,529
Australia.. ..	80	2,214	0	0
Canada	264	2,448	231	2,006
Irish Free State..	309	958	179	1,734
Other countries ..	36	985	84	931
Total	1,189	18,934	1,226	16,304
SWINE				
Argentina	21	280	6	130
Denmark	18	354	3	60
Finland	11	280	0	0
Hungary	37	783	0	0
Poland	19	329	4	198
Russia	0	0	44	1,065
Australia.. ..	13	564	0	0
Canada	21	325	0	0
Irish Free State..	102	645	52	1,026
Other countries ..	11	255	26	678
Total	253	3,815	135	3,157

THE following extract from the final report of the Saskatchewan Royal Grain Inquiry Commission (September, 1929) is reproduced here as indicating the

The Saskatchewan Wheat Pool value of co-operative marketing of grain. The Commissioners state :—

We briefly recount some of the achievements of the Pool as we have seen evidence of them.

Although in operation for a period of only five years, it controls by virtue of its inherent worth and appeal, and without any compulsion, 55 per cent. of the crop grown in the prairie provinces. What this means in volume and in exportable surplus in comparison with other countries is fully set out in our Interim Report.

It owns and operates some 1,435 country elevators out of a total of 5,042 spread over the prairie provinces and, in addition, it owns a large percentage of the large terminal elevators.

It has taken a leading part in helping to open up markets for the prairie grain in China and Japan and other countries, and has placed its handlings in over 60 different ports in Europe.

It has by its large control of grain been able to carry out a system of more orderly marketing and thereby helped to promote stability in prices.

It has been and will be a great force in bringing about remedial legislation in the interest of the producer, not only in connexion with the Canada Grain Act, but in other legislation as well.

It has helped to train its membership in citizenship.

It has brought about a spirit of independence and self-confidence on the part of the farmer in carrying out his various business enterprises.

It has enabled its member to meet with his fellow-farmers and discuss better methods of conducting business and carrying on farming enterprises in a way that he has never experienced before.

It has enabled its membership to feel that the marketing of their grain was in the hands of men who are capable, who understand world conditions, and who have no interest to serve except that of the producers.

It has, by operating in a large way, been able to operate in an economical way.

It has enabled its patrons to share in all terminal elevator earnings.

It has stimulated and helped in a movement for promoting clean and pure seed and special varieties of grain suitable to the soil and climatic conditions.

It has provided a grade checking department whereby every sample of wheat pooled is checked over after inspection, and a re-inspection or appeal is called for whenever it is in the interest of the grower that such should be done.

It was the first to introduce and install the automatic sampler in its terminals, an instrument which will soon be of general application and mean much to a correct system of grading.

It requested and helped bring about, through the National Research Council co-operating with the Agricultural Departments of the Western Universities, a scientific investigation into improved methods for drying tough and damp grains, which will be of incalculable benefit to producers.

It showed the way for settling with the farmer for mixed grains on the basis of separations where such separations are possible, and thereby saving to the farmer as much as over \$300.00 per car, as set out with greater detail in our Interim Report under the heading, "Mixed Grains."

In many other ways too numerous to detail here the Pool, both directly and indirectly, has meant much to the Pool member.

* * * * *

DURING November, prices of agricultural produce rose by two points to an average of 44 per cent. above the level of the base years 1911-13, as compared with a

The Agricultural rise of two points to 41 per cent. at the
Index Number corresponding period last year. The latest increase was due primarily to the higher

prices ruling for milk, the reductions in the figures for grain, fat sheep and eggs being offset to a large extent by advances in the indices for fat cattle and pigs.

Percentage increase compared with the
average of the corresponding month in
1911-13

Month	1924	1925	1926	1927	1928	1929
January	60	71	58	49	45	45
February	61	69	53	45	43	44
March	57	66	49	43	45	43
April	53	59	52	43	51	46
May	57	57	50	42	54	44
June	56	53	48	41	53	40
July	53	49	48	42	45	41
August	57	54	49	42	44	52
September	61	55	55	43	44	52
October	66	53	48	40	39	42
November	66	54	48	37	41	44
December	65	54	46	38	40	—

Grain.—Values for all three kinds of grain were lower on the month; wheat was cheaper by 1d. per cwt., barley by

10d. and oats by 4d., and the relative index numbers fell by 3, 10 and 6 points to 24, 11 and 6 per cent. above pre-war. In the case of barley and oats the November price levels were the lowest reached during the past three years, but on two occasions, viz., September, 1928, and June, 1929, the index for wheat has been a little lower than the November figure.

Live Stock.—Fat cattle were slightly dearer than in October, and the index number rose by two points to 33 per cent. above 1911-13. Quotations for fat sheep were also a little higher, but as a proportionately larger rise took place in November of the base period, the index figure showed a fall of two points. Prices of both bacon and pork pigs advanced, the former by 2d. and the latter by 7d. per 14 lb. stone, and the relative index numbers appreciated by six points to 56 and 70 per cent. in excess of the base levels. A year ago baconers averaged 24 per cent. over pre-war and porkers 33 per cent. Dairy cows became rather dearer on the month, but as the increase was relatively less than in 1911-13 the index figure declined by one point. Store cattle were on average about 13s. per head dearer than in October and the index number rose by four points to 15 per cent. over pre-war. Values for store sheep advanced also by nearly 3s. 6d. per head, while the index for the same reason as in the case of fat sheep was two points below that recorded during the preceding month. Store pig prices have continued to rise and at 108 per cent. in excess of 1911-13 the November index was higher than in any month since April, 1927.

Dairy and Poultry Produce.—Milk contract prices were generally 1d. per gallon above those ruling in October, and the index figure showed a rise of 12 points to 67 per cent. over the base level, whereas at the corresponding period last year milk averaged 71 per cent. in excess of pre-war values. Butter was unchanged in price during November, but the index number dropped by five points to 50 per cent. and a similar fall occurred in the index number for cheese to 32 per cent. over 1911-13, while the price was 2s. per cwt. lower. Values for eggs showed a further advance, as is usual at this period, but the index figure was 27 points lower on the month at 54 per cent. over pre-war, as compared with 51 per cent. in November, 1928, and 47 per cent. in November, 1927. It has been noticeable in recent years that the rise in egg prices between September and October has been rather more marked than the rise between October and November, and as the contrary was the case in the base period in 1911-13, the

indices for the last six Novembers have shown a fall. The fall, however, is more marked this year owing to the fact that the October index was exceptionally high. The index figure for poultry was two points lower on the month at 43 per cent. in excess of the base years.

Other Commodities.—Potatoes were a little cheaper on the month, but as the fall was proportionately less than in 1911-13 the index number appreciated by one point to 18 per cent. above 1911-13. A year ago, the corresponding figure was 53 per cent. Both clover and meadow hay were unchanged in price, but as the former showed a rise in the base years, the index number fell by two points; with meadow hay, however, the movement in 1911-13 was in a downward direction, and this caused the November index to gain five points. The combined index figure for hay was one point higher at 41 per cent. in excess of pre-war. Apples averaged 37 per cent. above 1911-13 as compared with 30 per cent. in the preceding month, and 60 per cent. a year ago. Vegetables were 63 per cent. dearer than pre-war as against 54 and 33 per cent. respectively a month and a year earlier. The difference between the level in this November and last is attributable chiefly to the higher prices for Brussels sprouts, cabbages and cauliflowers.

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1927	1928	1929			
	Nov.	Nov.	Aug.	Sept.	Oct.	Nov.
Wheat	34	31	46	31	27	24
Barley	45	25	31	27	21	11
Oats	30	27	30	17	12	6
Fat cattle	19	31	36	34	31	33
Fat sheep	40	53	59	55	55	53
Bacon pigs	18	24	60	52	50	56
Pork pigs	29	33	60	55	64	70
Dairy cows	28	38	35	35	34	33
Store cattle	13	20	19	16	11	15
Store sheep	35	53	64	63	53	51
Store pigs	44	31	85	83	95	108
Eggs	47	51	59	57	81	54
Poultry	46	47	47	45	45	43
Milk	59	71	93	107	55	67
Butter	47	52	48	52	55	50
Cheese	55	78	62	42	37	32
Potatoes	76	53	2	12	17	18
Hay	19	4	41	42	40	41
Wool	46	66	47	47	42	41

A READER of this Journal has drawn attention to an apparent discrepancy on page 734 of the issue for November, 1929, in the article on "Pig Recording in East Anglia."

**Pig Recording
in East Anglia**

There, among other statistical information relating to the litters recorded, the average live weight of the pigs was given as 217.4 lb., the average dead weight as 159.7 lb., and the percentage of loss from live to dead weight as 22.4. Taking the average live and dead weight figures stated above, the reader mentioned calculated the loss from live to dead weight as 26.5 and not 22.4 per cent. The latter figure is, nevertheless, correct. The seeming discrepancy arises from the fact that whilst the live weight given is the average of all the pigs weighed alive and, similarly, the dead weight is the average of all those weighed dead, the percentage loss from live to dead weight is calculated from the records only of those pigs for which both live and dead weights were obtained. In tabulating shortly the statistical information referred to, the possibility of the items being compared had been overlooked. The accuracy of the loss figure can be seen from a study of the more detailed information set out in columns 7 to 11 of Table II in the First Report of the East Anglian Pig Recording Scheme.* This explanation is given for the benefit of any other readers who may also have found difficulty in reconciling these particular figures.

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THE Ministry has recently considered what further steps could be taken to guard against the appearance of Wart Disease in the important potato-growing

**Potatoes in
Private Gardens
in Lincolnshire**

areas around Boston and Wisbech. A considerable quantity of the produce of the potato fields in this district is exported every year, but the trade is dependent on the continued freedom of the producing districts from wart disease, because practically all the importing countries require a certificate from the Ministry that there has been no case of wart disease within at least 5 kilometres (about $3\frac{1}{2}$ miles) of the place where the potatoes were grown. A slight outbreak, even in a cottage garden, in the producing districts would, therefore, result in stopping the export of potatoes from an area of about 30 square miles, and a few such outbreaks might entirely prevent the export of potatoes from the whole of this important district.

* Published by the Department of Agriculture, University of Cambridge. Price 1s. 2d., post free.

More than 90 per cent. of the outbreaks of wart disease recorded in this country have occurred in private gardens and allotments, and it was considered that an additional safeguard would be provided by the issue of an Order restricting potato planting in such premises to certified stocks of immune varieties, i.e., potatoes which are the subject of a "True Stock" certificate. This suggestion was favourably received by the two National Societies representing allotment holders, and by the Minister's Potato Advisory Committee, which is comprised of representatives of all the important associations interested in the potato trade; this Committee recommended that action on the lines indicated should be taken.

The Minister has accordingly made the Wart Disease of Potatoes (Amendment) Order of 1929, which comes into force on January 1, 1930. It applies to the following area: the administrative county of Lincoln (parts of Holland), including the Borough of Boston; the Petty Sessional Division of Wisbech and the Borough of Wisbech in the administrative county of the Isle of Ely; and the Petty Sessional Division of Freebridge Marshland, and the Borough of King's Lynn in the administrative county of Norfolk. Within this area potatoes which are not certified stocks of an approved immune variety may not be planted in any allotment not exceeding a quarter of an acre in extent or in any private garden. Exceptions from this requirement have, however, been made in respect of (1) the following five early varieties which are not immune from the disease: "Sharpe's Express," "Eclipse," "Epicure," "May Queen," and "Duke of York"; (2) potatoes of immune varieties saved from the crop grown on the same land in the previous year; and (3) before June 30, 1930, any potatoes saved from the crop grown on the same land in 1929.

Copies of the Order and lists of the approved immune varieties may be obtained on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

* * * * *

As a result of a conference held early in 1928 with trading and other representative organizations, the London School

Lectures on Tropical Hygiene of Hygiene and Tropical Medicine has instituted a series of courses in Tropical Hygiene for men and women (outside the medical profession) proceeding to the tropics. Up to the present five courses have been held with

an approximate total attendance of 90, and the next course will probably be held in March, 1930.

Each course consists of a series of lectures amounting to 12 hours; this has been arranged by giving either 12 lectures each of 1 hr. or 8 lectures each of $1\frac{1}{2}$ hr. A syllabus of the subjects dealt with in the lectures may be obtained from the School; it is believed that the subjects include most of the matters pertinent to the object of the course. Variation in the instruction is made as required by the destination of those attending any particular course; for instance, when none of the students are bound for Africa mention of sleeping sickness is omitted. On some occasions the course has consisted of 9 periods of $1\frac{1}{2}$ hr. each, i.e., $13\frac{1}{2}$ hr. instead of 12 hr., and in these cases opportunity has been taken to show kinematograph films on malaria and hookworm, these having a valuable educational interest. The instruction is given in simple and non-technical language, so that the lay mind may have no difficulty in understanding the matter.

Inquiries should be addressed to the Secretary, London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C. 1.

* * * * *

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on December 11 and 18, at 7 Whitehall Place, London, S.W. 1.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying these decisions into effect.

Berkshire.—An Order continuing the operation of the existing minimum and overtime rates of wages from December 22, 1929, until December 20, 1930. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 41 hours in the weeks in which Christmas Day and Good Friday fall and 50 hours in any other week, with overtime at $8\frac{1}{2}$ d. per hour. In the case of female workers of 19 years of age and over the minimum rate is 5d. per hour for all time worked.

Cornwall and Isles of Scilly.—An Order cancelling as from December 14 the existing minimum and overtime rates of wages and fixing fresh rates to come into operation on December 15, 1929, and to continue in force until December 20, 1930. The minimum rate in the case of male workers of 21 years of age and over is 32s. (instead of 31s. as at present) per week of 33 hours in the week in which Christmas Day and Boxing Day fall; 42 hours in the weeks in which Good Friday and Whit Monday fall, and 51 hours in any other week, with overtime at 9d. per hour on weekdays and 10d. per hour on Sundays. In the case of female workers of 20 years of age and over the minimum rate is 5d. per hour for all time worked.

Gloucestershire.—An Order cancelling as from December 21 the existing minimum and overtime rates of wages and fixing fresh rates to come into operation on December 22, 1929, and to continue in force

until October 7, 1930. The minimum rates in the case of male workers of 21 years of age and over are: *Head carters* 36s. per week of 52½ hours in the week in which Christmas Day falls and 60 hours in any other week in winter; 34s. 6d. per week of 51 hours in the week in which Good Friday falls, and 58 hours in any other week in summer; *Under carters* 34s. 6d. per week of 50½ hours in the week in which Christmas Day falls and 57 hours in any other week in winter; 32s. 6d. per week of 48 hours in the week in which Good Friday falls and 54 hours in any other week in summer; *Head shepherds or Head stockmen* 36s. per week of 52½ hours in the weeks in which Christmas Day and Good Friday fall and 60 hours in any other week; *Under shepherds or Under stockmen* 34s. 6d. per week of 50½ hours in the weeks in which Christmas Day and Good Friday fall and 57 hours in any other week; *Other male workers* 30s. per week of 39½ hours in the week in which Christmas Day falls, 48 hours in any other week in winter; 41 hours in the week in which Good Friday falls and 50 hours in any other week in summer. Overtime is payable in the case of all classes of male workers at 9d. per hour on weekdays and 11d. per hour on Sundays, Christmas Day and Good Friday. In the case of female workers the minimum rate is 5d. per hour for all time worked irrespective of age.

Hampshire and Isle of Wight.—An Order continuing the operation of the existing minimum and overtime rates of wages from December 22, 1929, until December 20, 1930. The minimum rate in the case of male workers of 21 years of age and over is 30s. 6d. per week of 40½ hours in the week in which Christmas Day falls and 48 hours in any other week in winter; 41½ hours in the week in which Good Friday falls and 51 hours in any other week in summer. The Order provides that in the case of a worker who is given a clear day's holiday in the week following that in which Good Friday falls the number of hours in respect of which the minimum weekly wage is payable shall be 51 in the week in which Good Friday falls and 41½ in the following week. The overtime rate in the case of male workers of 21 years of age and over is 8d. per hour except in the case of the employment of carters, cowmen, shepherds or milkers on work in connexion with the immediate care of animals when the overtime rate is 7½d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for all time worked.

Norfolk.—(1) An Order to come into operation on December 29, 1929, when the existing minimum and overtime rates of wages are due to expire and to continue in force until December 27, 1930. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 42 hours in the week in which Good Friday falls and 50 hours in any other week in summer; 40 hours in the week in which Christmas Day falls and 48 hours in any other week in winter with in addition, in the case of teamsmen, cowmen, shepherds and yardmen, 5s. 6d. per week, and in the case of sheep tenders and bullock tenders 4s. 6d. per week to cover employment in excess of those hours on duties in connexion with the immediate care of animals. The overtime rates in the case of all classes of male workers of 21 years of age and over are 9d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays.

(2) An Order fixing special minimum and overtime rates of wages for male workers employed on the corn harvest in 1930. In the

case of workers of 21 years of age and over employed throughout the harvest, the wage payable in respect of the harvest is an inclusive sum of £11. In the case of workers who are not employed for the full harvest period special differential rates have been fixed for overtime employment on the corn harvest, the rate in the case of workers of 21 years of age and over being 9½d. per hour.

Somerset.—An Order cancelling as from December 14 the existing minimum and overtime rates of wages and fixing fresh rates to come into operation on December 15, 1929, and to continue in force until December 20, 1930. The minimum rate in the case of male workers of 21 years of age and over is 32s. per week of 32½ hours in the week in which Christmas Day and Boxing Day fall and 50 hours in any other week in winter; 42½ hours in the weeks in which Good Friday, Easter Monday and Whit Monday fall, and 52 hours in any other week in summer. Provision is made for a modification of the hours of work in certain weeks where alternative holidays are given in lieu of any of the public holidays mentioned. The overtime rate in the case of male workers of 21 years of age and over is 9d. per hour except for employment on the hay and corn harvests when the rate is 10d. per hour. In the case of female workers of 21 years of age and over the minimum rate is 6d. per hour for all time worked.

Surrey.—An Order cancelling as from December 21 the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor to come into operation on December 22, 1929, and to continue in force until December 20, 1930. The minimum rates in the case of male workers of 21 years of age and over are: horsemen, stockmen or shepherds, 38s. 8d. per week of 51 hours in the weeks in which Christmas Day and Good Friday fall, and 60 hours in any other week; other male workers, except casual workers, 32s. 3d. per week of 41 hours in the weeks in which Christmas Day and Good Friday fall and 50 hours in any other week; casual workers 7½d. per hour. Provision is made for the payment of the minimum weekly wage (except in the case of casual workers) in respect of the reduced number of hours in Easter week instead of in the week in which Good Friday falls if a holiday is given on Easter Monday in lieu of one on Good Friday. The overtime rates in the case of all classes of male workers of 21 years of age and over are 10d. per hour on weekdays and 11½d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 5½d. per hour with overtime at 7d. per hour on weekdays and 8d. per hour on Sundays.

North Riding of Yorkshire.—An Order cancelling as from December 14 the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor, to come into operation on December 15, 1929, to continue in force until further notice. The minimum rate in the case of male workers of 21 years of age and over is 34s. (instead of 33s. as at present) per week of 48 hours in winter and 52½ hours in summer, with in addition payment at 3d. per hour in the case of workers who are boarded and lodged by the employer and 6d. per hour for workers who are not so boarded and lodged in respect of employment in excess of those hours on the care of and attendance upon animals. The minimum rate for male casual workers of 18 years and over is 6d. per hour for all time worked. The overtime rates of wages for male workers of 21 years of age and over, other than casual workers, are 10d. per hour on weekdays and 1s. per hour on

Sundays. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour for a week of 44 hours, with overtime at 9d. per hour.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Enforcement of Minimum Rates of Wages.—During the month ending December 14, legal proceedings were instituted against 15 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows:—

County	Court	Fines			Costs			Arrears of wages	No. of workers in- volved
		£	s.	d.	£	s.	d.		
Gloucester	.. Chipping Campden..	1	0	0	—			12 6 11	1
Leicester	.. Leicester	4	0	0	1 15	0		18 5 4	2
Lancaster	.. Blackburn	1	0	0	1 7	0		50 0 0	2
"	.. Kirkham	1	0	0	0 2	0		25 0 0	1
"	.. Prescott	3	0	0	1 19	0		36 9 0	3
Salop	.. Newport	1	0	0	0 5	0		1 15 1	1
Wilts	.. Tisbury	*			—			3 9 10	3
Yorks, N.R.	.. Thirsk	3	0	0	0 7	6		60 0 0	1
" W.R.	.. Barnsley	0	1	0	0 10	0		20 0 2½	1
Brecon	.. Brecon	*			0 4	0		13 10 0	1
Cardigan	.. Tregaron	0	7	6	0 10	0		5 1 0	1
Denbigh	.. Denbigh	0	10	0	—			8 15 9	1
"	.. "	0	10	0	—			0 3 8	1
"	.. Llangollen	—			0 13	0		10 0 0	1
Pembroke	.. Mathry	1	0	0	1 7	0		9 15 1	1
		£16	8	6	£8	19	6	£274 11 10½	21

* Dismissed under Probation of Offenders Act.

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Foot-and-Mouth Disease.—Outbreaks have been confirmed at two fresh centres as follows: at the City Abattoir, Glasgow, on November 23; and at Avonbridge, Muiravonside, Stirlingshire, on December 17. The usual restrictions were applied to areas of approximately fifteen miles radius round the infected premises. The restrictions in the case of the Glasgow outbreak were withdrawn on December 16.

No further outbreaks having occurred in the East Sussex Infected Area, referred to in the December issue of this JOURNAL, the restrictions in force in that area were withdrawn on December 7.

Since January 1, 1929, thirty-seven outbreaks have been confirmed in fourteen counties, involving the slaughter of 1,231 cattle, 1,098 sheep, 1,217 pigs and 5 goats.

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Leaflets issued by the Ministry.—Since the date of the list given in the August, 1929, number of this JOURNAL, p. 492, the following leaflets have been issued:—

New:—

- No. 333. Feeding Stuffs for use with Cereals in Pig Feeding.
- No. 75. Stomach Worms in Sheep.

Revised:—

- No. 5. Mangold Fly.
- No. 89. Fluke, or Liver Rot in Sheep.
- No. 244. The Destruction of Rats.

Amended :—

No. 279. Technical Advice for Farmers.

No. 146. The Value of Records of the Milk Yield of Cows.

Rewritten :—

No. 304. "Husk" or "Hoose."

No. 365. Onion and Leek Smut.

A single leaflet is supplied by the Ministry, on request, free of charge. If more than one leaflet is required a charge at the rate of 1d. each or 9d. per dozen is made.

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APPOINTMENTS**COUNTY AGRICULTURAL EDUCATION STAFFS :
ENGLAND.**

Cornwall: Mr. A. B. Bates, B.Sc., N.D.A., has been appointed Lecturer in Agriculture, *vice* Mr. R. H. Smith, B.Sc.

Derby : Mr. R. H. Smith, B.Sc., has been appointed District Agricultural Lecturer.

Essex : Mr. O. G. Dorey, B.Sc., has been appointed Assistant Lecturer in Horticulture, *vice* Mr. H. Fraser, N.D.H., promoted to the post of Lecturer and Adviser in Commercial Horticulture.

Miss V. D. Harrison, N.D.P., N.D.D., has been appointed Assistant Instructress in Poultry-keeping.

Northants: Mr. L. F. Gregory, N.D.A., N.D.D., has been appointed Assistant Instructor in Dairying and Poultry-keeping *vice* Mr. G. Wells, N.D.A., N.D.D.

Oxford : Miss B. C. Beaumont, N.D.D., B.D.F.D., has been appointed Instructress in Dairying and Poultry-keeping *vice* Miss V. C. Stamper, N.D.D., B.D.F.D.

Salop : Mr. T. B. Evans, B.Sc., has been appointed Agricultural Lecturer.

Mr. R. Duncan has been appointed Horticultural Lecturer.

Westmorland : Mr. L. R. Waugh, B.Sc., has been appointed Agricultural Instructor.

**COUNTY AGRICULTURAL EDUCATION STAFFS :
WALES.**

Flint : Miss V. D. Harrison, N.D.D., Instructress in Poultry-keeping, has resigned her appointment.

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NOTICES OF BOOKS

Plant Diseases.—By F. T. Brooks, M.A., F.L.S. Pp. vi + 386. (London : Oxford University Press. (Humphrey Milford.) 1928. Price 21s. net.)

The author of this book is well known as University Lecturer in Botany at Cambridge University, and as one who has had considerable experience in training students to serve as plant pathologists both at home and in overseas parts of the Empire. His endeavour, in preparing this book, has been to fill an admitted gap in the plant disease literature of this country by providing a reliable book on plant diseases suitable for use by students of botany, agriculture, horticulture and forestry, as well as by enlightened cultivators of crops.

Of the 22 chapters into which the book is divided, 13 deal with plant diseases due to fungus parasites, and 4 with those due to bacteria, Actinomycetes, Myxomycetes and algae respectively. There

is an introductory chapter, and those remaining deal with non-parasitic diseases, virus diseases, fungi and their classification, and fungicides.

There are 59 illustrations, all of which are new. Some of them are from half-tone photographic blocks and others are from line drawings. One or two of the former leave something to be desired in clearness, perhaps, but for the most part the figures are satisfactory; some readers may feel that a greater number of them would be an advantage. There is an adequate index.

The book does not purport to be a treatise on plant pathology as a discipline, but is rather one that deals in the main with the marshalling of the very large number of parasitic diseases of crop plants that occur at home and in various parts of the Dominions and Colonies; it provides descriptions of their symptoms, special regard being had to their more purely mycological aspects, and indicates control measures when such are possible. The diseases described, therefore, are arranged according to the systematic position of the causative parasites, and not according to host plants or to the physiognomy of the diseases themselves. This method of treatment, whilst being by no means new and, in certain respects perhaps, not altogether ideal, will nevertheless be found convenient by many students, who will also appreciate the useful lists of selected references to the literature that are appended to nearly all the chapters. The book is thoroughly up to date and covers a great deal of ground. A few misprints and other minor errors have escaped final proof-reading, but they do not materially detract from the value of the book and can be set right when there is a call for a second edition. In view of its general usefulness and of the considerable clientèle to which it will appeal this will probably not long be delayed. All our mycologists and plant pathologists will wish to have the book on their reference shelves.

The Feeding of Domestic Animals.—By Professor Nils Hansson. (Fütterung der Haustiere: Ihre theoretischen Grundlagen und ihre wirtschaftliche Durchführung, von Nils Hansson. Übersetzt von Franz von Meissner; überarbeitet und mit einem Vorwort versehen von Professor Dr. Georg Weigner.) Second Edition, 1929. Pp. xiv+274. (Dresden: Verlagsbuchhandlung Theodor Steinkopff. Price: paper covers, 10 marks.)

The first edition of this work appeared in 1926. It was reviewed appreciatively in the May, 1927, issue of this JOURNAL. In the present (1929) edition, Professor Hansson has reviewed the subject matter of the former edition in the light of the progress which has been made in animal nutrition research during the last decade. A chapter on vitamins, their distribution and significance, has been inserted. The question of the biological value of the constituents of feeding stuffs is also dealt with. Other new features of the present edition include: accounts of feeding stuffs which have been introduced recently into feeding practice; the scientific aspects of poultry nutrition; the regulation of bulk in the feeding of farm animals; the mineral requirements of different classes of farm stock. The tabular matter in the final section has been augmented by the inclusion of data showing the reactions of the ash constituent of the common feeding stuffs.

The Rat.—By A. Moore Hogarth, with a preface by Sir Thomas Horder, Bart., K.C.V.O., M.D., F.R.C.P. (London: John Bale, Sons & Danielsson, Ltd. Price, 7s. 6d.)

This volume deals with various aspects of the rat problem, and contains suggestions for their control by all the known methods. A preface by Sir Thomas Horder clearly states the need for the proper control of pests in general, with special reference to the rat.

Celery Production and Marketing in the Isle of Axholme.—By Arthur Jones, B.Sc., and S. M. Makings, N.D.A. (Survey Studies No. 1, Midland Agricultural College, Sutton Bonington, Loughborough. Price 1s.)

Although the acreage devoted to celery has been much increased of recent years, the Isle of Axholme has long specialized in this crop. It is grown wherever the water table is constantly high, on soils which vary from warps, sands and gravels, blown sand, peat, and alluvium, but the quality of the produce varies considerably. From the peat lands come, early in the season, the heavy crops of somewhat coarse sticks; the warp celery is sweet, crisp and of very fine quality; while the celery from the loams ranks midway between the other two. Soils with a high proportion of coarse sand produce second-grade celery; the crop is difficult to bleach and comes to market in unattractive form.

Some of the specialist growers cultivate celery continuously on the same land, but it is more usual to adopt a rotation in which the celery is followed by potatoes, two cereal crops, seeds, and roots before returning to celery again. In either case, the land has to be very highly manured with "dung," and as supplies of this are decreasing and becoming increasingly costly, an alternative method of manuring the crop is desirable. The authors, while pointing out the necessity for maintaining an abundant supply of humus in the soil, nevertheless definitely recommend a more extended use of fertilizers. They advise growers to use tested seed, attributing a poor harvest in many cases to careless selection of seed. Celery "blight" usually results from the use of infected seed, and few samples are free. A clear and accurate account of celery production is given; the methods by which the young plants are raised in frames (both hot and cold) are described, as also are the general methods adopted in planting out, cultivating, earthing up for bleaching and in lifting.

The section on marketing describes the factors governing choice of markets, methods of disposal and the grading and packing of celery for market. Wholesale prices are also discussed and some well-arranged graphs are supplied showing the average prices realized at different markets over a period of years.

Of outstanding interest at the present time, when the marketing of agricultural produce is receiving such close attention, are the description and results of a marketing experiment on a commercial basis carried out during the season 1928-29. This experiment was aided by a grant from the Ministry. Regular consignments of celery were dispatched to three northern markets during the months of November, December and January, on a pre-arranged basis. Under the system adopted, comparisons between graded and ungraded supplies were made possible, and the results show a profit of several pounds per acre in favour of the graded celery.

In general, Lincolnshire celery is of a poorer quality than that grown in districts around Manchester and, in order to secure as high a reputation as possible for their produce, Lincolnshire growers are recommended to dispense with the common practice of tying poorer sticks in the middle of bundles, and to adopt, instead, a standardized form of grading and packing approved by a central organization of growers working in conjunction with the Markets Division of the Ministry, which will, no doubt, issue, in due course, suitable grading and packing standards under the Agricultural Produce (Grading and Marking) Act, 1928.

The authors state that, compared with the trade in the United States of America and in many Continental countries, the retail celery trade in this country is undeveloped; its expansion might confidently

be expected with improved methods of marketing, while the consumption of celery would be appreciably increased if the celery were offered in a more attractive form. Figures showing the consumption of celery in this country are not available; but the quantity produced, excluding produce from home gardens, allotments and holdings of one acre and less, may be estimated at about 50,000 tons, which is roughly 3 lb. per head of the population per annum.

Celery is a vegetable which can be enjoyed either cooked or raw, but, whilst hawkers find it a useful crop to handle and are accustomed to trim and wash it before sale, the present general lack of an attractive method of presentation, of a standardized system of grading and packing, and of organized marketing by the growers, does not encourage sales by the retail trade.

The facts presented are well set out, and the book can be recommended to all interested in the celery industry.

Bulletins of the Institute for Research in Agricultural Engineering.

Bulletin No. 3.—Report of trials of the Combine Harvester-Thresher in Wiltshire, 1928. By J. E. Newnan and J. H. Blackaby, B.Sc., pp. 50, illustrated. (Oxford: Clarendon Press. Price, 2s. 6d. net.)

Bulletin No. 4.—A report on the Development and Costs of the Oxford Process for the Production of Sugar from Sugar Beet. Pp. 55, illustrated. (Oxford: Clarendon Press. Price 2s. 6d. net.)

The titles of these bulletins are self-explanatory, but it may be said that the first deals with a single series of trials and that the second is a continuation of reports previously published, a list of which is given in the preface. The Combine harvester-thresher used in the trials in 1928 is fully described in Bulletin No. 3, which also contains a note on the future of the combine in England. Bulletin No. 4 provides useful data on the costs at Eynsham and of a factory twice its size as well as many other costs, and is hopeful of further economies that may be effected by the use of the process when its recent developments are fully worked out.

British and Irish Writers on Agriculture.—Compiled by W. Frank Perkins. Pp. 142. (Chas. T. King, High Street, Lymington. 1928. Price 10s. 6d. net.)

In the Introduction to his bibliography, Mr. W. Frank Perkins disarms criticism by suggesting that it is impossible to produce a complete bibliography of agricultural books, especially for the nineteenth century. His book contains a list, arranged alphabetically under authors, of some 1,300 writers from the earliest printed books on agriculture up to and including the year 1900.

This was a piece of work that badly needed to be done. No agricultural bibliography of the nineteenth century had been attempted before this work was published, and we owe a debt to this writer for his efforts to implement the necessity. It is uncertain whether the arrangement of the matter is the best that could be devised, however, and it may be suggested that in any reprint Mr. Perkins should add a chronological list, or at least a chronological index, of authors, which would be of great service to the student using his book.

While referring to arrangement, it may be added that the entries are not set out uniformly. The general lay-out is author, title, place of publication, size, but this arrangement is not adhered to, and no indication of the pagination is given. In some cases the date, imprint and size are all omitted; in others the imprint and size, and in yet others the size only. These are details which could easily have been obtained by the author if he had seen the books, failing which they could have been specifically described as not obtainable.

The character of this bibliography suggests that it is, at least in part, a compilation from other catalogues, and it repeats a number of mistakes that have been, so to speak, part of the heritage of agricultural bibliographers.

Winter Riches, 1771, is attributed, following McDonald, to John Dove and to Matthew Peters. It was, of course, written by the latter. *A Treatise on Wool and Cattel*, 1677, is attributed to Roger L'Estrange, the licenser of books of the period, as is clearly shown by the title page reproduced in McDonald's *Agricultural Writers*. This error has been handed down from bibliographer to bibliographer, but neither Ernle nor the British Museum catalogue adopts it. Again following McDonald, Mr. Perkins lists T. Langford's *Systema Agriculturae*, 1681 fol., but this is John Worlidge's book. By an unfortunate printing accident no book titles are given under the author Batty Langley. Could Arthur Young have had anything to do with Bishop Fleetwood's translation of *Curiosities of Nature and Art in Husbandry*, etc., issued in 1707? Four books are listed under Samuel Trowell (and William Ellis), but Ellis was only concerned in the expansion of the two editions of *The Farmers' Instructor*, the following two books being Trowell's work. As to *The Practice of Modern Husbandry*, by Trowell, this is apparently a discovery of Mr. Perkins', and must be in one of the provincial libraries he has explored.

There are, of course, so many details connected with bibliographical work that it is almost impossible for any bibliographer to make his work completely impregnable, but such points as have been mentioned should have been cleared up before the book was issued. Moreover, in the sources given in the Introduction, Mr. Perkins has omitted two of the most recent pieces of agricultural bibliography: the articles on English printed books on agriculture to 1700, by G. E. Fussell, which appeared in *The Bookman's Journal* between 1926 and 1928, and the *Bibliography of British History, Stuart Period, 1603-1714*, edited by Godfrey Davis, 1928.

Although there are these defects in the book, it must be remembered that it is a pioneer work so far as the nineteenth century is concerned, and no doubt in any future edition it will be possible to improve it. Meanwhile it forms the only attempt at a bibliography of the subject covering the whole period from the publication of Fitzherbert's books to 1900, and as such should be of very great service to the student of agricultural history.

Wool: A Study of the Fibre.—By S. G. Barker, Ph.D., D.I.C., F.Ins.P., M.I.Chem.E., F.R.S.E., F.Z.S. Empire Marketing Board, 21. Pp. 166. (London: H.M. Stationery Office. 1929. Price 1s. 6d. net.)

This volume was written at the request of the Empire Marketing Board to prepare the way for future developments in the study of wool. It is designed to serve both as a summary of the existing state of scientific knowledge on the subject, and, to some extent also, as a confession of scientific ignorance. It is written, not only for specialists, but also for agriculturists, industrialists and administrators who are interested in wool problems, and, perhaps, especially for new recruits to biological research.

The volume traces the history of wool from the very earliest times up to the present day with its world problem of relating the production of mutton with a wool of even thickness and good manufacturing value. The evolution of the coat of the sheep is studied generally and biologically in all its variations of type, structure, growth, pigmentation and quantity. The chemical, physical and dimensional

characteristics of wool are also studied, and their value to the manufacturer and to the wearer of the manufactured product are assessed.

The author claims that the question raised early in the volume "What is Wool?" has only been incompletely answered. One may venture to suggest, however, that he has taken us far along the road towards the answer, and that the volume will be of the greatest assistance to all interested in wool, whether in the field, the laboratory or the factory.

* * * * *

ADDITIONS TO THE LIBRARY

Plant Pests and Diseases

Appel, Dr. O.—Krankheiten des Kern-und Steinobstes. I, Teil : Kernobst. (24 pp.+24 pl.) (Parey's Taschenatlanten No. 4) Berlin : Paul Parey, 1929. [63.24-41 ; 63.27-41.]

Appel, Dr. O.—Krankheiten des Kern-und Steinobstes. II, Teil : Steinobst. (24 pp.+24 pl.) (Parey's Taschenatlanten No. 5.) Berlin : Paul Parey, 1929. [63.24-41 ; 63.27-41.]

Snell, Dr. K.—Krebsfeste Kartoffelsorten (Potato Varieties immune to Wart Disease). (24 pp.+24 pl.) (Parey's Taschenatlanten No. 7) Berlin : Paul Parey, 1929. [63.512.]

Ministry of Agriculture and Fisheries.—Misc. Publication No. 61. Weeds of Arable Land, by *H. C. Long*. (139 pp.+94 pl.) London : 1929, 2s. 6d., 3s., and 3s. 6d. [63.259.]

Alcock, N. L., and Braid, K. W.—The Control of Bracken. (Reprinted from the Scottish Forestry Journal, Vol. 42, Part 2 (Oct., 1928), pp. 68-73.) Glasgow : West of Scotland Agricultural College, 1928. [63.259.]

New Jersey Agricultural Experiment Station.—Bulletin No. 468. Studies of Arsenical Injuries and Correctives. (16 pp.) New Brunswick, 1929. [63.294.]

U.S. Department of Agriculture.—Technical Bulletin No. 111. Fish Oil as an Adhesive in Lead-Arsenate Sprays. (28 pp.) Washington, 1929. [63.295.]

Live Stock and Feeding

Cambridge University, Department of Agriculture.—Animal Nutrition Research Institute : First Report on the East Anglian Pig Recording Scheme, by *H. R. Davidson* and *A. N. Duckham*. (47 pp.) Cambridge, 1929, 1s. [63.64.]

Experiment of Feeding Sheep on Growing and Wilted Sugar Beet Tops on Mr. F. R. Debenham's Estate at Briantspuddle, Dorset. (4 pp.) [63.60432 ; 63.631 : 043.]

U.S.A. National Research Council of the National Academy of Sciences.—Bulletin No. 67. The Minimum Protein Requirements of Cattle : Report of Committee on Animal Nutrition. (84 pp.) Washington, 1929. [612.394 ; 63.62 : 043.]

Missouri Agricultural Experiment Station.—Bulletin No. 266. Soybeans and Soybean Oil Meal in Swine Rations. (20 pp.) Columbia, 1929. [63.60432 ; 63.64 : 043.]

University of Leeds and the Yorkshire Council for Agricultural Education.—No. 156b. Data on the Gross Composition, Digestible Organic Nutrients and Inorganic Substances of Farm Foodstuffs, together with the derived figures summarizing their Food Value and Manurial Value. Leeds, 1928. [543.1 ; 612.394 ; 63.60433.]

University of Leeds and the Yorkshire Council for Agricultural Education.—No. 156a. The Composition, Food Value and Manurial Value of Various Farm Foods, Leeds, 1928. [543.1 ; 612.394 ; 63.60433.]

Empire Marketing Board.—E.M.B. 18. The Composition of Pastures, by J. B. Orr. (39 pp.) London: H.M. Stationery Office, 1929, 9d. [63.33.]

Dairying

Oxford University, Agricultural Economics Research Institute.—Progress in English Farming Systems: I, Milk Production on Arable Land, by F. J. Prewett. (21 pp.) Oxford: Clarendon Press; London: Humphrey Milford, 1929, 2s. 6d. [63.191; 63.70.]

University of Leeds and the Yorkshire Council for Agricultural Education.—No. 142. The Production of Clean Milk. (11 pp.) Leeds, 1926. [614.32; 63.71; 63.717.]

Ministry of Agriculture and Fisheries.—Misc. Publication No. 65. Variations in the Composition of Milk. (19 pp.) London, 1929, 4d. [63.71; 63.712.]

Rippin's Butter Fat Ready Reckoner, No. 270. Leicester: Rippin's Books Co., 1929, 5s. [63.712.]

Illinois Agricultural Experiment Station.—Bulletin No. 316. An Experiment in the Free-choice Feeding of Mineral Supplements to Dairy Cattle. (pp. 118-124) Urbana, 1928. [612.394; 63.711; 043.]

Small Live Stock

Brown, E.—Poultry Breeding and Production: Vol. I (pp. 1-408 + 68 pl.); Vol. II (pp. 411-864 + 52 pl.) London: Ernest Benn, 1929, 50s., two vols. [63.65.]

Capper, A. H.—One-man Poultry Farming. (Third Revised Edition.) (55 pp.) London, 1929, 1s. [63.651.]

Midland Agricultural and Dairy College.—Bulletin No. 22. Table Poultry Production: Report on Investigations conducted on the College Farm, 1927-28, by R. B. Shaw and Miss V. Milner. (20 pp.) Sutton Bonington, 1929. [63.651.]

Thomas, V.—Commercial Rabbit Farming. (Third Edition). (102 pp.) London: Bazaar, Exchange and Mart, 1929, 3s. 6d. [63.69.]

Veterinary Science

Leeney, H.—Home Doctoring of Animals. (353 pp.) (New Edition.) London: Macdonald & Martin, 1929, 15s. [619.]

Harper Adams Agricultural College.—Some Cattle Diseases; Contagious Abortion, Tuberculosis, Mastitis (Garget); Report of Conference held at the College on Tuesday, April 9, 1929. (24 pp.) Newport, Salop. [614.54; 619.2.]

Australia, Council for Scientific and Industrial Research.—Pamphlet No. 12. The Cattle Tick Pest and Methods for its Eradication. (23 pp.) Melbourne, 1929. [59.169.]

New York State Department of Farms and Markets.—Bulletin No. 218. Bovine Tuberculosis: Its History, Control and Eradication. (147 pp.) Albany, 1928. [614.54.]

Colonial Office.—Report of a Committee appointed by the Secretary of State for the Colonies on the Colonial Veterinary Service. (44 pp.) [Cmd. 3261.] London: H.M. Stationery Office, 1929, 9d. [37; 619; 619.]

Corporation of London.—Public Health Department. Report by Lieut.-Col. T. Dunlop Young, Veterinary Surgeon, on his Visit to Australia and New Zealand in connection with Methods of Inspection and Exportation of Meat, together with a Memorandum of the Medical Officer of Health thereon. (59 pp. + 12 pl.) 1929. [614.31; 614.9 (9); 63.75.]

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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NOTES FOR THE MONTH

THE warble fly is found in all parts of Great Britain, and farmers are well aware of the trouble caused to their cattle when the fly is on the wing, interfering

The Warble Fly: with grazing and rest as it seeks to lay its eggs on the hair of the legs of the animals.

A National Campaign "Gadding," which in the case of dairy cows also affects the milk supply, is,

however, only one of the sources of worry and loss caused by the pest. The presence of the warbles under the skin of the back damages the underlying flesh, the damage varying according to the number of parasites harboured by the beast concerned. The hides also are seriously damaged by the puncture which each warble makes as a breathing pore, and through which it emerges when its life cycle in the animal is complete. Tanners and many users of leather are greatly inconvenienced by these damaged hides, which cause considerable losses to the leather industry.

The effects of the warble fly are, therefore, felt in many industries, and it has been computed that the annual aggregate loss in the country is not less than £1,000,000.

These considerations caused the Ministry to appoint a Committee to investigate the problem of the pest, and in its Report, published in 1926, the Committee advised several alternative methods which are capable of destroying a high percentage of the warbles at or about the time of their emergence.

In recent years, many farmers have treated their animals for the destruction of warbles and have reduced the infestation of their herds. Individual measures, however, can be only partially successful, as reinfestation will occur from neighbouring herds. *Action by all farmers in an area is important if the best results are to be secured.*

In addition to these individual efforts, the Worcestershire Agricultural Education Sub-Committee carried out demon-

strations on a larger scale during the warble seasons of 1928 and 1929 with highly encouraging results.

A campaign on a national basis is being planned by a Committee, appointed by the Leathersellers' Company, and comprising representatives of all the industries interested in the subject, and some of the County Councils. It is intended that operations against the parasite shall be begun during the coming season. The enormous losses caused by it can be mitigated by an effort on the part of stockowners, at very small expense in cost of materials for killing the warbles, and the Ministry hopes that the activities of the Committee will be supported by farmers.

A leaflet on the life history of the Warble Fly and its destruction may be obtained free on application to the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W. 1. Literature is also obtainable from the Honorary Secretary, Leathersellers' Warble Fly Committee, Leathersellers' Hall, St. Helens Place, London, E.C. 3, and farmers may consult the County Organizer of the local County Council.

* * * * * *

The Ministry's report on the agricultural output and the food supplies of Great Britain, which has just been published,*

**The Agricultural
Output and the
Food Supplies of
Great Britain**

is of considerable interest as the first serious attempt to deal comprehensively with the subject of the nation's food supplies, and to show the relative importance of agriculture among the industrial activities of this country. In its review of these questions the report assembles data concerning the various sources of agricultural production, and affords a comparison with other industries, which are of great value and interest to all those who are concerned in any way with the study of agricultural problems, and also to students of the economic position of Great Britain. The report brings up to date as far as possible the information already published in regard to the gross output of agriculture, and gives additional information as to the purchase of raw materials contributing to the home agricultural output, without which an estimate of the net output has not hitherto been possible. The report also shows what proportion of the total food

*H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 1s. net or 1s. 2d., post free.

supplies derived from both agriculture and fisheries is of home origin, or is received from foreign or Empire sources, a comparison which is of more than usual interest at the present time. The value and interest of the information indicated above is considerably enhanced by its comparison with that for pre-war years.

* * * * *

For many years past Devon has been noted for the excellent quality of its butter and cream, and the best butter and cream produced in the county is, indeed,

**Devon Butter
Producers'
Association**

second to none. It cannot be denied, however, that while the best butter is of a very high standard, there is much so-called Devonshire butter on the market which is of very inferior quality. This state of affairs has had unfortunate results, among which may be mentioned the lowering in value of the genuine article because of the unevenness of the sample, an increase in the practice of blending butter, with the possible consequence that, public taste becoming vitiated by the blended product, there will be a decrease in the demand for the unblended home-made butter, and the fact that many of the best makers have given up butter-making in favour of the more lucrative business of milk selling.

In these circumstances, a pioneer body of butter makers in the county decided that steps should be taken to preserve the reputation of Devonshire butter, and to obtain for this excellent product the publicity it deserves. This resolve was impelled by the conviction that, agriculture being the chief industry in Devon, it was of vital importance that the demand for products of the farm should be maintained and improved in every respect.

The Devon Butter Producers' Association was, accordingly, established as an officially recognized body or institution to which buyers could be referred as a reliable source from which genuine Devonshire butter could be obtained. The main objects of the Association are :—

- (a) To preserve the reputation of and maintain confidence in Devonshire butter amongst the general body of consumers, and thereby promote the demand for it throughout the United Kingdom.
- (b) To encourage the production of genuine Devonshire butter of the highest quality that it is possible to produce.
- (c) To organize and develop the marketing of butter, and especially to improve and extend the market for Devonshire butter.

Accrediting Members.—A Committee of practical butter-makers, known as the Licensing Authority, deal with all applications from members of the Association who wish to become Accredited or Licensed members, and the procedure is briefly as follows :—

On receipt of an application for a Licence, the applicant's premises and methods are inspected by a member of the County Dairying Staff. Far more importance is attached to the methods of production than to the buildings, and the advice of the person visiting the farm is gladly given in regard to improving or correcting faults in the methods of production.

After inspection of the premises, the applicant is requested to forward a sample of butter to the County Agricultural Analyst. This is tested for moisture, curd and salt, and is then placed in an incubator at a given temperature, which is considerably higher than any dairy should reach, to ascertain how long it will keep. No sample is accepted as having passed the test unless it can be reasonably expected to keep for at least fourteen days in the summer (April to September) and at least twenty-one days in the winter (October to March).

Reports on the inspection of the methods and premises, and on the analysis of the sample of butter, are submitted to the Licensing Authority, and, if both are up to the high standard required, a licence is granted.

Having received the licence, the licensed member obtains from the Association butter wrappers bearing the mark illustrated. Each wrapper is serially numbered and can be obtained only from the Association. A licensed member is supplied with a monthly record sheet on which is recorded the amount of butter made and sold and the name of the purchaser, and these have to be returned to the Association on the first day of each month.



Income.—A fee of 1s. per cow is charged on entering the Association. This entry fee is charged once only and does not recur each year. The income of the Association is mainly derived from the sale of the marked wrappers, the charge being 4s. per 100 for the pound size, and 2s. per 100 for the half-pound size. The wrappers are serially numbered, and by

this means, in conjunction with the monthly record sheets, the Association is able to trace not only the maker of the butter but the dates on which it was made and sold, thereby protecting the interests of both the licensed members and the consumers.

Marketing.—The Association is a non-trading body, the actual marketing being left in the hands of individual members. All inquiries received at the Association's offices as a result of advertising undertaken by the Association are passed on to the licensed members for attention.

A high standard of efficiency is aimed at, and samples for examination may be called for at any time and surprise visits paid. Every effort is being made by the members to produce a first quality article, and purchasers can be confident that scrupulous cleanliness is the aim from the cow to the table, and that the butter contained in the Association's wrapper is the best it is possible to produce.

Results to Date.—During the short time the Association has been operating, the membership has reached 41, and over 8,000 wrappers have been sold to the 13 members who have so far been licensed. It will be appreciated that the inspection of the premises and methods, and the analysis of the sample, particularly in regard to keeping quality, takes time, but it is expected that licensed members will rapidly increase in number.

The prices obtained by the members so far licensed have been as much as 2d. per pound above the top local market prices, and the promoters of the Association were fully justified in assuming that there is a large number of consumers with whom quality is the first essential and who are quite prepared to pay a little extra for a first-class article. In guaranteeing the produce the Association is taking every possible precaution to ensure that the consumer who requires real Devonshire butter shall be able to get it.

* * * * *

THROUGH an unfortunate typographical error in the note on the Glasshouse Industry, which appeared on page 802 of the December, 1929, issue of this JOURNAL, the acreage of glasshouses in the Lea Valley was given as "approximately 14,000." The correct acreage is approximately 1,400.

THE following note has been communicated by Mr. A. W. Oldershaw, M.B.E., B.Sc., Agricultural Organizer for East Suffolk :—

Drought and Crop Production As is well known the growing season of 1929 was in most parts of England characterized by a very low rainfall.

Arable crops, however, did not as a rule suffer from drought so much as might have been expected. In fact, on heavy and medium land those corn crops which were not injured by the winter frost succeeded well. This was strikingly the case in the Midland and Eastern Counties. In a journey through the Fens in early harvest the writer inspected some of the heaviest standing crops of corn he ever saw. The typical heavy corn growing lands of this country seem capable, with the moderate temperatures which we experience, of growing good crops of corn with an extremely low rainfall. Since harvest the thrashing machine has generally shown that there is a very good yield of corn in proportion to the straw, and that heavy yields per acre have been obtained. The old saying that "Drought never brought Dearth to England" is indeed true. The winter rainfall preceding the growing season of 1929 was so low that reserves of moisture in the soil must have been very small. On a heavy land farm which is under the writer's management, the pipe drains were only once observed to run during the winter 1928-9, and then for a very short period only.

It is probable that the great power of resisting drought possessed by arable crops, especially corn crops, last year, was in part due to the very fine tilth which resulted from the previous winter's frost. When the frost went out of the land in early March, 1929, a fine dry tilth, in some cases almost a dusty tilth, was left, and no doubt this acted as a mulch to retain moisture in the land. It is also likely that corn crops felt the drought less owing to the fact that, although dry, the weather during the growing season of 1929 was not as a rule very hot, while in most cases the nights were cool. There was a short hot spell in July, but with that exception the hottest weather of the year was in September, after the corn was ripe.

The condition of the grass land, even in the best grazing districts of the Midlands, was in a marked contrast to that of the arable. The cold dry spring prevented the grass, even on good old pasture, from making a satisfactory start. There can be no doubt that over a great area the productivity of our

grass land during the summer of 1929 was very low. Where it was mown for hay very small crops resulted, and where it was grazed stock required more concentrated food than usual to enable them to make average progress, or to maintain the milk supply. The bareness of the pastures in England during a dry season causes doubt as to whether we are right in pinning our faith so implicitly to grass. It is universally admitted that arable land is immensely more productive of food both for man and beast. It is only the low price of the products of tillage, together with the high costs of production, that cause the British farmer to resort to grass. Whatever policy, arable or grass, the farmer may find it necessary in future to adopt, it seems a sound policy to reflect carefully upon the relative productivity of old and new grass, and of allied forage plants during the past very remarkable season.

In a good many cases much better crops of hay were obtained on fields recently laid down with modern grass mixtures than on old meadows. Very valuable information has been obtained within the last few years on the subject of grass mixtures, and by using these modern mixtures it is possible to obtain a very heavy crop of hay for the first few years after sowing, if suitable manuring is adopted. The great superiority of modern grass mixtures over those in vogue thirty years ago is apparently due in part to the inclusion of one or two pounds per acre of wild white clover seed. Another feature of the modern grass mixture is the omission of smaller grasses and the inclusion of larger quantities of rye-grass, cocksfoot and timothy. If the new meadow is constantly mown and heavily manured with nitrogenous manure the competition of "top" grasses tends to smother out the wild white clover. If, however, the grass is cut early in the season and the aftermath is carefully and closely grazed, this smothering effect is by no means so marked, and it is possible to obtain a carpet of wild white clover over the whole of the ground in the second or third year after sowing, given fairly favourable conditions. Phosphatic and potassic manuring, together with close grazing, tend to encourage the formation of this carpet of wild white clover.

Land recently seeded down with a modern mixture usually makes an earlier start in spring than do old meadows. In a dry spring such as that of 1929, this early start may result in a good cover being obtained before the severity of the

drought is felt. In this way the great superiority of crop obtained last season on new as compared with old grass may in part be accounted for. Lucerne, in districts where it will grow, is immensely more productive than grass—probably two or three times more productive. Moreover, it gives excellent results when grown in admixture with mowing grass, and it greatly increases the productivity and drought-resisting powers of the meadow. The modern system of inoculating lucerne now being developed at Rothamsted will probably extend the area over which this most valuable plant can be grown with success. Sainfoin also in certain districts is a very valuable plant and more productive than grass.

* * * * *

UNDER the provisions of the Orchard and Garden Diseases Act, 1928, the Governor-General of New Zealand has issued an Order in Council, dated November 11, 1929, prohibiting absolutely the introduction into New Zealand from any country or place of hop-sets of any variety of hop plant. The Order took effect as and from November 14, 1929.

**Introduction of
Hop-sets into
New Zealand
Prohibited**

By a second Order in Council, taking effect on the same date, downy mildew of the hop (*Pseudoperonospora humuli*) is declared to be an additional disease to be included in the First Schedule of the Act above mentioned.

* * * * *

THE world agricultural census, promoted by the International Institute of Agriculture, has now reached the stage of being actually carried out. The success of this undertaking of the Institute was ensured from the very moment that all the governments of the world promised their cordial collaboration.

**The World
Agricultural
Census**

The Institute has prepared a comprehensive census programme, which was carefully studied by its International Scientific Council and agreed by the technical delegates of all the adhering governments. Further, Mr. Leon H. Estabrook, late Director of Agricultural Statistics of the United States of America, placed by that Government at the disposal of the Institute, which committed to him the preparatory work of the agricultural census, was entrusted by the Institute with the mission of visiting the several countries in order to give the necessary information and any assistance required.

The Institute has been in daily receipt of information respecting the activities carried out by the different governments, in connexion with the taking of their censuses. The following particulars recently communicated by the Institute are of special interest :—

The Argentine Republic has informed the Institute that the date fixed for the taking of its census is June 30 next.

Greece took its census from December 11-20, 1929.

Switzerland has also already taken its census and is now tabulating the returns. Egypt is likewise tabulating its returns.

The programmes drawn up by the several countries for taking their respective censuses offer some very interesting features. Thus, in France, farmers have organized a prize competition for monographs dealing with the several areas, to be written according to a comprehensive programme and in order to complete the census. The Greek Government has decided that the Departmental Commission shall, through the agency of their technical experts, check on the spot all the data collected by the communes ; this check will be carried out on not less than one-fifth of the communes of each province. Mexico, which will carry out its census next May, took an experimental census in the State of Morelos on July 25 last.

The above information is gathered from the mass of documentation that the Institute is collecting on the census organization of each country. In due course the whole of this documentation will form most valuable evidence for the purpose of appreciating the full significance of the experience acquired in the several countries. It can therefore be said that the final results of the world agricultural census will not only give the figures of the world agricultural inventory, but will be accompanied by a methodological documentation which will be of the greatest value in the organization of future censuses.

So far as the United Kingdom is concerned arrangements are being made for a census to be taken in 1930-31 in England and Wales, Scotland and Northern Ireland, by the agricultural departments of the three countries. It may be mentioned that the Annual Statistics collected by the Ministry under the Agricultural Returns Act, 1925, are sufficient to enable the Ministry to furnish the greater part of the information desired by the International Institute of Agriculture. In connexion with the special inquiries, however, a mid-winter census of live stock on agricultural holdings in England and Wales on January 11, 1930, has been undertaken by the Ministry.

THE first meeting of the Agricultural Conference, to consider the present state of agriculture, was held at 10 Downing Street on the morning of January 17. The following representatives were present:—

For the National Farmers' Union	Capt. E. T. Morris, J.P. Mr. H. German „ R. R. Robbins, C.B.E. „ E. W. K. Slade „ E. G. Gooch, C.C., J.P. „ W. Holmes „ J. Beard „ G. Dallas, M.P.
For the National Union of Agricultural Workers	Sir George L. Courthope, Bt., M.P.
For the Transport and General Workers' Union	Capt. R. C. Bourne, M.P.
For the Central Landowners' Association	The Rt. Hon. E. G. Pretyman
For the Land Union	Col. E. A. Ruggles-Brise, M.P.

At the opening of the proceedings the Conference was presided over by the Prime Minister, the Rt. Hon. James Ramsay MacDonald, M.P., who was accompanied by the Rt. Hon. Noel Buxton, M.P., Minister of Agriculture, and the Rt. Hon. C. Addison, M.D., M.P., Parliamentary Secretary.

The Prime Minister made a general statement as to the genesis of the Conference and its scope, after which general statements were made by the representatives.

The proceedings were resumed in the afternoon at the Ministry of Agriculture, when Mr. Buxton was in the chair. Questions of procedure were decided and a discussion followed on the present conditions of cereal growing.

It was arranged that the second meeting of the Conference should be held at the Ministry of Agriculture on Friday, January 24, at 11 a.m.

* * * * * *

ACCORDING to returns made to the Ministry by the beet sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during December, 1929, together with the quantity produced during the corresponding month in 1928, was:—

**Production of
Home-Grown
Beet Sugar**

	Cwt.
December, 1929 ..	1,815,676.
December, 1928 ..	1,299,954.

The total quantities of sugar produced during the two manufacturing campaigns to the end of December were:—

			Cwt.
1929-1930 .. ..	..	..	5,331,769
1928-1929 .. ..	..	..	3,718,051

LINKAGES BETWEEN LIVING CREATURES

J. ARTHUR THOMSON, M.A., LL.D.,

Professor of Natural History, University of Aberdeen.

THE struggle for existence is a phrase to be used, Darwin said, in "a large and metaphorical sense," including much more than life-and-death competition for food and foothold. It comprises all the endeavours, unconscious as well as conscious, that living creatures make against surrounding difficulties and limitations. It may be for food, for standing room, for mates, for luxuries; it may be between fellows of the same kind, between foes of different kinds, between rivals in love, or between living creatures and the non-living environment, such as cold and drought. The major reasons for the struggle for existence are four: (1) the tendency of organisms to be prolific; (2) the fact that the system of animate Nature is based on successive re-embodiments or reincarnations, one creature eating another, and all ultimately depending directly or indirectly for subsistence on green plants; (3) the changeableness and indifference of the physical forces, which often put living creatures on their mettle; and (4) the unsatisfied claims that vigorous plants and animals are ever making, for they are self-assertive, insurgent hustlers, always asking for more, and that not only for themselves, but for their offspring as well. In a very important sentence in his *Origin of Species*, Darwin spoke of the struggle for existence "including the dependence of one being on another, and including (which is more important) not only the life of the individual, but success in leaving progeny." He also pointed out very emphatically that while there is often internecine competition around the platter of subsistence, as when one starving locust or rat devours its fellow, there may be another way out—by mutual aid, by social co-operation, by entering into some partnership, by linking lives together.

Inter-relations.—It is now obvious why we began this study of linkages with the struggle for existence, for it is the unending clash between organisms and their environments that has in great part led to the multitude of inter-relations. A perched plant, such as many a tropical orchid, lives high above the ground on the branch of a tall tree, for it is easier and more profitable to dispense with soil-water than to do without light and fresh air. There are hundreds of different kinds of these perched plants or epiphytes, dependent on rain-water and its dust particles; and behind the strange experiment that they

have unconsciously made—namely, living out of touch with the ground—there is the struggle for existence, the “woodland warfare” of the tropical forest. The perched plants have become linked to their support, and the same is even more markedly true of the numerous climbing plants or lianas which are unable to stand on their own legs, yet succeed in expanding their leaves on the topmost branches of their bearers. Sometimes their success is their ruin, for they may become so heavy that they break down the tree, or so strong that they kill it by strangling or smothering.

The tropical “ox-peckers” (*Buphaga*) perch on cattle or rhinoceroses and pick off parasites, such as ticks, from the skin, as we may see starlings doing to sheep in Britain. They illustrate a temporary linkage, useful to both parties. One of the plovers (*Pluvianus ægyptius*) removes leeches and other parasites from the back of the crocodile, and may even enter its mouth “to pick its teeth” as Herodotus alleged—another instance of association, which, though loose, is by no means casual. Now these are certainly not mere curiosities of Natural History, for they are instances of what is very common; and our point is that the prompting that is behind most of them is to be found in the struggle for existence. Necessity is the prepotent mother of invention, though we must allow some influence also to the father—the inquisitive and venturesome spirit!

Fundamental Linkages.—In a previous study on the Balance of Nature* we illustrated the following inter-relations which are so important that they must be called fundamental: (1) the direct or indirect dependence of the animal world on the photo-synthesis of carbon-compounds that goes on in all green plants; (2) the nutritive chains which link animals in a series, such as gull—codfish—large whelk—worm—animalcules; (3) the part that bacteria play in breaking down dead animals and plants so that there is a production of water, gases, and salts which may be re-absorbed by plants and thus re-enter the cycle of life; and (4) the inter-relations between the majority of flowering plants and those insect-visitors that may be metaphorically called “welcome,” since they effect the cross-pollination which secures the production of fertile seeds. Thus, to mention Darwin’s classic case, expounded in the *Origin of Species* (1859), the pollination of red clover depends on the visits of humble-bees—and is thus correlated (a) with the field-mice or voles, which destroy the nests of the bees, and (b) with the cats which roam in the fields and kill the voles,

* This JOURNAL, December, 1929, page 813.

even if they do not eat them, and (c) with the number of kindly ladies who keep cats in the villages. Haeckel humorously connected the clover with roast beef, and thus with John Bull, and his tendency to be masterful!

Continuance of the Race.—The freshwater mussels, common in many rivers and ponds, produce eggs in early summer, and these, after being fertilized by inwafted sperms, proceed to develop in the cradle of the outer gill-plate of the mother mollusc. They develop until they become pinhead-like bivalved larvæ called glochidia; but these are not allowed to escape till midsummer, and, even then, not until some freshwater fish, such as a minnow, comes swimming slowly past. The simple constitution of the minute larvæ is attuned to respond excitedly to the presence of fishes, and by snapping their valves and exuding glutinous threads, they manage to attach themselves to the skin, fins, or gills of the minnow. After a period of semi-parasitism, ending in a very remarkable metamorphosis, the little mussels drop off into the mud, often far from their birthplace. Now the continuance of the race of freshwater mussels is dependent on this temporary linkage with certain freshwater fishes; and the linkage is sometimes so precise that only one particular species of fish will excite the larvæ to secure attachment. Very remarkable is the further fact that the little Continental freshwater fish called the bitterling (*Rhodeus amarus*) lays its eggs, by means of a long ovipositor, in the gills of the freshwater mussel; and again this temporary parasitism is obligatory.

In the same sort of way, though less intimately, many plants depend on particular animals for the distribution of their seeds. Thus the missel thrush plants the mistletoe, and its lack of altruism in this connexion is obvious enough from the fact that it may leave the glutinous mistletoe fruit on a telegraph wire! The most striking instance, an eloquent illustration of our present theme, is Darwin's record that he got eighty seeds to germinate from one clodlet on the foot of a red-legged partridge.

Plant and Plant.—The linkages between plant and plant are many, and some of them are of great practical importance. We take a few representative illustrations.

In many forest-trees, such as pines and beeches, a fungus, apparently related to one or other of the many moulds that are common in the soil, forms a feltwork over the roots. It has been shown that this association is useful, not harmful,

to the trees; and there is little doubt that the investing fungus helps the roots to absorb the soil-water. When the external fungus sends some of its threads or hyphæ into the tissue of the root, it may be able to absorb carbon-compounds which the plant has built up in its leaves. Otherwise it does not seem to gain much from its partnership.

Frequency of Root-Fungus.—In many other cases, as in heaths, the root-fungus or mycorrhiza is chiefly internal, and its filaments make their way into the interior of some of the cells. The fungus can absorb organic matter from its green partner; but it is not very clear what benefit the partner gets in return. For some terrestrial orchids it has been proved that the fungus can fix free nitrogen, and when this is effected, it is not difficult to see that the root may be benefited by digesting some of the fungoid threads. In other cases it is possible that the fungus-partner changes the nutritive material in the roots into some more useful form, just as is done by the partner-yeasts in the food-canal of cockroaches, or the partner infusorians in the food-canal of white ants. Perhaps the most difficult instances of the mycorrhiza or root-fungus partnership are those in which the flowering-plant is without chlorophyll, and is therefore unable to make carbon-compounds for itself by the usual photo-synthesis. This is to be seen in the peculiar Bird's Nest orchis (*Neottia nidus-avis*) and in the quaint North American plant called Indian Pipes (*Monotropa*). The so-called Coral-root (*Corallorhiza*) is also without chlorophyll, and the mycorrhiza fungus is found in the underground stem, for in spite of its names this strange plant is rootless. The Bird's Nest orchis feeds saprophytically on organic matter in the soil, and the same is probably true of the two others. So it is not easy to say what the internal fungus-partner does, *unless* it fixes atmospheric nitrogen.

Fungi and Orchids.—It has been known for a long time that it is very difficult, and often impossible, to rear imported orchids from seed. Bertrand, a French botanist, discovered that this was due to the fact that the seed will not sprout, or, if it sprouts, will not produce more than a sickly seedling, unless it is penetrated and partnered by an appropriate fungus. This is normally abundant in the orchid's native soil, but it may be absent in Britain. In certain cases the orchid seed will accept a substitute fungus, but Bertrand convinced himself that the finer orchids were very fastidious, so to speak, and would not germinate or thrive unless the seeds

found their own appropriate partner. The seeds of orchids are very small and not well equipped with reserve material, and it is probable that the mycorrhiza fungus rapidly establishes a nutritive connexion with the soil. Perhaps it also secretes a stimulating ferment into the seed. As many orchids live off the ground, as perched plants on trees, it may be that the mycorrhiza fungus is able to fix atmospheric nitrogen.

One of the outstanding biological facts in many parts of Britain is the success of the heather, which is able to flourish in unready moorland soils where almost nothing else will grow. What is the secret of the heather's success? The answer that Miss Rayner has given so convincingly is that the heather succeeds because it is not one plant but two. It has a partner-fungus which sends its threads through and through the whole plant, from root to shoot, from leaf to flower, and even into contact with the unsown seed. In some way that is not as yet clear the heather-firm flourishes, and the same is true of some other members of the order Ericaceæ.

Root Tubercles.—Another linkage of great practical importance is that between leguminous plants and certain microbes (*Bacillus radicicola*) that form tubercles in the roots and multiply there to the great advantage of the crop. In some way that is not, as yet, understood, the bacteria in question are able to fix the free nitrogen mixed with the soil-water, and to increase the quantity of nitrogen-compounds in the green plant. This explains why soils are so much improved by ploughing in clovers, vetches, and the like, which have been able to bring about in a quiet way what man has in modern times effected with very powerful electric discharges—the fixation of the nitrogen of the air. The probability is that the partner bacilli fix the free nitrogen which is contained in the aerated soil-water absorbed by the roots; and it has been proved beyond doubt that a leguminous plant with root-tubercles can increase in nitrogenous compounds far beyond what can be accounted for by the mineral composition of the soil. The bacilli batten on the sugars and the like that they find in the cells of the root; they multiply and spread and cause some deterioration in the plant: but the green plant soon gets the upperhand and begins to utilize the nitrogenous compounds which the fungus has somehow made available. The fungi become inactive and they are eventually digested and absorbed by the root—a very advantageous proceeding. Thus lupins can flourish on the river-shingle, broom on the gravelly railway cutting, rest-harrow on the

dunes. The partner bacteria do not live for more than the season ; so if the leguminous plant is more than an annual there must be a fresh infection of fresh rootlets every year. The symbiotic nitrogen-fixing bacillus is not to be confused with others in the soil, e.g., *Nitrosomonas*, that oxidize ammonia (from decaying organisms) into nitrites, and others, e.g. *Nitrobacter*, that oxidize nitrites into nitrates, such as ordinary plants absorb as nitrogenous raw material.

Sharing a Parasite.—Among the linkages that mean much to man and to his interests are those in which widely separated living creatures share a parasite between them. Liver-rot in sheep is due to the Liver fluke (*Distomum hepaticum*) ; and the larval stages of this troublesome Trematode parasite are sojourners in the small freshwater snail (*Limnæus truncatulus*). So sheep and snail are interlinked ; and a third link is added when we notice that some birds, such as the pied wagtail, have a wholesome appetite for the water-snail, and are thus, as they should be for other reasons, the sheep-farmer's friends.

The very peculiar Trematode parasite Bilharzia, which infects man very seriously in warm countries, has its larval stages in various freshwater snails, and the abundance of these in ponds and pools is increased by a stronger growth of lotuses and other water-plants on which they browse, and is decreased by the multiplication of aquatic birds that pick them off the leaves. The microscopic larvæ usually enter man through the skin. The contamination of the water is mainly due to careless sanitary arrangements which allow the microscopic egg-cells in the fæces or in the urine (according to the species of Bilharzia) to pass from the infected child or adult into the water. In the Japanese species (*Schistosomum japonicum*) the parasite infects cattle as well as man, and the water may be contaminated by droppings from the cattle as they stand in the pools.

It is interesting to linger over the linkages of the Bilharzia worm—with man, with freshwater snails, with freshwater plants, with aquatic birds, and so forth. How intricate and ravelled the web may become ! Every third child in Cairo is infected with Bilharzia, for children paddle or bathe in the water. It is said that bilharziasis does not occur in Moslem children in Durban, for they are not allowed to bathe in public. It is easy to understand why the parasite should be common among washerwomen and among gardeners who use unfiltered water for the flowers. The microscopic larvæ enter by minute cracks in the skin. Yet there are cases of infection

among people who do not use unfiltered water, and in some of these cases it has been proved that infection is due to lettuces and the like hawked by dealers who have steeped the vegetables in ordinary water. It may be noticed that if tablets of sulphate of soda are dissolved in the water, the microscopic larvæ are killed off; and it was shown by Leiper that the larvæ in drawn water which is kept quite still die within thirty-six hours. The point is that the *Bilharzia* life-circle intersects many other circles and often in subtle ways!

If man is to continue his conquests of parasites, he must in many cases do what Leiper did in the case of *Bilharzia* or *Schistosomum*, he must discover the life-history and the linkages with other living creatures. It is easy enough to understand that if man eats imperfectly cooked flesh of pig or ox infected with bladderworms, he will become infected by the adult stages or tape-worms, namely, *Tænia solium* and *Tænia saginata* respectively. The inter-relation is more complex when a dog eats the viscera of cattle or pig infected by the large *Echinococcus* bladderworms, and after developing the minute corresponding tapeworm, *Tænia echinococcus*, infects man with the microscopic eggs, either by direct contact or by contaminating dishes and food. The *Echinococcus* bladderworm that develops in man is often as big as an orange and may be fatal.

Some kind of tse-tse fly that has drawn blood, including microscopic Trypanosome organisms, from some native mammal, such as an antelope, in which a *modus vivendi* has been established on both sides, proceeds to bite man, horses, or cattle, and the Trypanosomes introduced into this new kind of host, without any counteractives or anti-toxins in its blood, cause sleeping sickness or similar diseases.

Malaria is due to the mosquito's introduction of a microscopic animal, *Plasmodium*, into man's blood. Anything that reduces the number of mosquitos must work against the spread of malaria. Thus there is great efficacy in pouring a little paraffin or petrol into the stagnant pools where the larval mosquitos develop. These larvæ are then unable to get a grip of the slippery oil-film on the surface of the water, and this prevents them from obtaining the fresh air requisite for breathing. So the larvæ die of suffocation, and in this way places like Khartoum were cleared of mosquitos, and thus of malaria, for a time at least. In some cases the paraffin method is impossible, since the water is used for drinking purposes; so that the expedient has been tried of introducing

small minnow-like fishes into the reservoirs, and with most beneficial results. For the small fishes devour the mosquito larvæ, and this checks malaria.

Intersecting Circles.—Another way of illustrating the web of life is to select a particular type of living creature and disclose the many vital interests which its life-circle intersects. Earthworms by their burrowing, bruising, and burying, have made most of the fertile soil of the world : but think of the number of circles which the earthworms' circle intersects. They bury leaves and they also plant trees ; they are eaten by many birds, such as thrushes ; they form a large part of the food of moles ; their reproductive organs always contain Sporozoon parasites ; they are perhaps in some cases the intermediate hosts of the gapes worm that chokes chickens ; they frequently give house-room in their kidney-tubes to minute Nematodes ; they are sometimes parasitized by maggots ; in their castings they bring to the surface microbes which may be those of Anthrax and prove very serious if they get into lesions in man's skin ; and so on and on the story goes. Put one leg of a giant pair of compasses in an earthworm's burrow, and describe a circle, how many different lives does the other leg intersect !

The white ants or termites of warm countries prune off the decaying branches of trees. As they dislike the light they make tunnels of salivated earth, so that they climb the trees without being exposed to the glare ; and in the course of many rain-storms the comminuted earth may come to be part of the alluvial soil of a distant valley. Termites often feed on fungi which grow within the termiteary on specially constructed mazy beds of chewed wood. Like true ants, many white ants keep as guests little beetles, which have a palatable or an aromatic exudation. Termites afford food to ant-eaters, many birds, and some reptiles. All wood-eating termites contain in their food-canal numerous Infusorians which are necessary to change the dry-as-dust food into a useful form. And so the story continues.

Perhaps we have said enough to vivify one of the central ideas of Natural History, that nothing lives or dies to itself, but everything, as John Locke said, is a retainer to some other part of Nature. In the course of time one life has been linked to another so that a web of inter-relations has been established. We can never tell beforehand where a thread in the fabric will lead to. If one is pulled out many are loosened. If man is to continue to hold and extend his kingdom, he must increasingly discover and respect the Web of Life.

LAMB DYSENTERY*

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Introduction.—A serious menace to sheep-breeding in the pastoral counties of the South of Scotland and North of England has arisen in the shape of a fatal disease among newly-born lambs. Lamb dysentery is the common name for the disease, but in accordance with district it is known by a variety of names, such as "Scour," "Red Scour," "Black Scour," "Lamb Disease," "Milk-ill," etc.

The disease is evidently widespread in Britain. From post-mortem examinations of lambs, its presence has been shown not only in the border counties, but from districts as far north as Perthshire to as far south as Cornwall. In fact, there is hardly a county in Britain from which the disease has not been diagnosed. The heaviest losses, however, have occurred in Northumberland and Cumberland in England, and in Berwickshire, Kirkcudbrightshire, Wigtownshire, Roxburghshire and Dumfriesshire, in Scotland. From the time that the disease was observed in Northumberland, about fifteen years ago, it appears to have spread farther afield each year. Abroad, lamb dysentery is believed to occur in Peru, and other parts of South America, and the occurrence of a disease resembling dysentery in lambs has been reported from Montana (U.S.A.) and from Africa. It probably also occurs on the Continent of Europe.

The first scientific records of the disease are those given by Gaiger, but it is probable that the condition has existed in localized areas of Britain for many years. Scattered references to what in all probability was lamb dysentery as we know it to-day are to be found in volumes published during the last century, and the writer has been able to collect reliable evidence of its existence on farms among the Cheviot Hills over one hundred years ago. There is some evidence to show that on certain hill farms the disease became so bad that breeding was abandoned, and the farms were used as "hogging farms" or else were made to carry "wether" stocks. Nowadays, all hill farms carry a breeding stock, and it may be that since the last change over these farms have served as centres from which the disease spread.

* Summary of a lecture given during the winter of 1928-29 at various centres within the Northern Advisory area.

Since the actual method of spreading lamb dysentery from farm to farm and from district to district is not fully known, the above must remain, to a certain extent, a matter of conjecture.

In the course of investigations into lamb dysentery the writer has been confronted with many puzzling and apparently irreconcilable facts, but when the disease appears upon clean farms or those hitherto free from the disease, certain almost uniform features are seen. For example, in a certain valley in Northumberland there are eight large hill farms all of which have been or are affected with lamb dysentery. Very few lambs were lost on any of those farms the first year the disease was noticed. The second year up to 10 per cent. of lambs born died from dysentery, up to 15 per cent. the third year, and in the following years the mortality on several of these farms reached 20 to 25 per cent. Sometimes, though not invariably, the disease is first noticed among the lambs born after "shedding-in" the late lambing ewes to a convenient field or meadow. Later, when the disease becomes established, it may occur on any part of the farm. As soon as the disease had reached a certain degree of severity upon the eight farms mentioned, and was accounting for as many as one lamb in every four or five born, for some reason or reasons it began to decline, and now several farms are entirely free from it, while on others the annual loss from lamb dysentery during the past two years has been under ten lambs.

A good deal of investigational work has been done on lamb dysentery during the last ten years. Certain problems connected with the epizootiology of the disease are still obscure, but many important conclusions have been arrived at, and in the writer's opinion a point has been reached when it may be said that lamb dysentery is a preventable disease. In what follows, a résumé of the various methods of preventing lamb dysentery is given, and for the sake of completeness a brief account of the symptoms and post-mortem appearances is included. It cannot be too strongly emphasized that the early recognition of the disease is of the utmost importance in preventing future losses.

Causes.—Early in the investigation of lamb dysentery it was realized that a knowledge of the cause was of paramount importance in suggesting methods of prevention and control. Various opinions have been expressed, but in the writer's view the most important contribution to our knowledge of the cause of lamb dysentery appeared in an article by

Dalling in the *Journal of Comparative Pathology and Therapeutics* for June, 1926. In this article, Dalling gives full particulars and shows that he was able artificially to infect young healthy lambs on a clean farm with a disease indistinguishable from lamb dysentery by the following methods:—

- (1) By feeding material from the intestine of naturally affected lambs.
- (2) By injecting similar material intravenously.
- (3) By feeding either a mixture of *B. welchii* and *B. coli*, or a culture of virulent *B. welchii*.
- (4) By intravenous inoculation of *B. coli*, followed by the feeding of *B. welchii* culture.

Dalling further states that the intravenous injection of small doses of virulent *B. welchii* culture produced the most characteristic artificially produced ulcers he had ever seen.

The conclusion that this lamb dysentery type of *B. welchii* organism is the cause of lamb dysentery is confirmed by the ability of its antitoxin to prevent lamb dysentery on infected farms. The writer's personal opinion is that the most certain method of preventing the disease is to inoculate newly-born lambs with the antiserum made from this germ. This indicates the important rôle that the lamb dysentery bacillus plays in causing the naturally occurring disease.

If it be agreed that this germ is the actual cause of lamb dysentery, and without which the disease cannot occur, it must also be agreed that there may be many contributing causes which predispose to the infection, of which the writer considers the following are important:—

- (a) *Lambing Arrangements*.—Shedding-in is practised both on hill and on lowland farms. On hill farms, only the late lambing ewes are shed-in, usually three or four score which are placed in a field near the shepherd's house. On lowland farms much the same process is carried out inasmuch as all the ewes are brought into one field to lamb, and after lambing they are moved out to "clean" or "hained" fields.

"Shedding-in" may predispose to lamb dysentery in so far as it transgresses the laws of good hygiene. One has frequently seen lambing fields which could only be described as foul; where the cleansings were never removed; and where the amount of sheep faeces was altogether too plentiful. Moreover, if a single lamb contracts dysentery under such conditions it is easy to understand how its spread to other lambs is facilitated. It must be admitted, however, that lamb dysentery occurs on farms where no "shedding-in" is practised.

- (b) *Condition of the Ewes*.—At one time it was thought that those lambs which sucked vigorously and filled themselves with milk were more prone to contract lamb dysentery, although the writer cannot say that he has found this to be the case, nor, indeed, has he yet seen hill ewes lamb down

in good condition, among the border hills at least. It must be exceptional for the ewes to have an abundance of milk in the early days of April. On the contrary, hill ewes have been seen extremely thin, and still lamb dysentery occurred among their lambs. Ewes on lowland farms are usually in much better condition at lambing time, and there is no reason to believe that their condition or the abundance of their milk has in any way affected the onset of lamb dysentery.

- (c) *Twinning of Lambs*.—Many shepherds believed that to transfer a healthy lamb to a ewe which had lost her lamb from lamb dysentery was the surest way of setting up dysentery in the twinned lamb. This, however, is not the case, as many instances have been observed of healthy lambs under a week old being twinned without the disease following. The probable explanation is that these lambs must be free of infection when they are twinned, or, in other words, must be obtained from farms where no dysentery occurs. Where the twinned lamb is obtained from the same "hirsle" or "cut" of sheep as the dead lamb, one cannot be certain that the lamb is not harbouring the disease at the time of twinning.
- (d) *Breed of Lamb*.—The disease is most commonly seen in Blackface and Cheviot lambs. Cross-bred lambs from ewes of the above breeds with the Border-Leicester tup seem to be more resistant to lamb dysentery.
- (e) *Age of Ewe*.—The writer considers that when the disease is at its height the greatest loss occurs among the lambs produced by the younger ewes. In this he is relying on the views of several experienced shepherds, since extended personal observations have not been made on this point.
- (f) *Effect of Weather*.—It has been noticed that a sudden snow-storm during lambing is followed by more deaths from lamb dysentery. It is, however, difficult to estimate the effect of stormy weather, since it may merely hasten death for the dying. On the other hand in stormy weather the ewes and lambs have repeatedly been seen to crowd together at the back of stone dykes, hedges, etc., seeking shelter, and by over-crowding the chance of spreading the disease may thereby be increased.

How the Disease is Spread.—Every disease caused by bacteria is contagious, *i.e.*, is spread by contact, and if, as the writer believes, lamb dysentery is indeed a bacillary infection of the bowels with a type of *B. welchii* organism, its contagious nature is at once evident. Now the disease is essentially an intestinal affection, the lesions of which are inflammation and ulceration, and during life the dysenteric stools are laden with millions of virulent germs. Consequently the germs contaminate the pasture, and it is known that they have a considerable power of resisting unfavourable conditions. Any arrangement of sheep farming which gives rise to overstocking, overcrowding or bad hygiene supplies precisely those conditions which are best calculated to suit the germ and propagate the disease. There would seem to be no solid ground for thinking that lamb dysentery is an ante-natal infection; the evidence

points to its post-natal origin. The lamb is born free of any taint of lamb dysentery, but the young animal may become infected very soon after birth, if not actually during its passage through the vagina. The more highly exalted in virulence the germ becomes through passage in the animal body, the fewer germs will be required to set up a fatal disease in the young lamb.

There should not be any difficulty about accepting the above general statements regarding infection, especially as experiments have demonstrated that healthy lambs can be infected by confining them to a small paddock which has been artificially contaminated with minced intestinal contents from lambs dead from dysentery. Conversely, it has often been shown that the loss from lamb dysentery can most certainly be saved by moving pregnant ewes from infected farms to clean land several days before lambing is due to commence. The difficulty of applying the above reasoning to all cases of lamb dysentery at once comes to mind when we remember the large extent of most hill farms, and the obstacles in estimating when overstocking or overcrowding is actually occurring. Further, in certain feeding experiments, where the disease has been set up artificially, comparatively large doses of *B. welchii* culture have been required, even when the culture has been obtained from hyperacute, naturally-occurring cases. Still, it must be evident that the difficulties of reproducing natural conditions in these artificial experiments is a very real one, and it is possible that further knowledge will elucidate points which at present appear puzzling.

With regard to the spread from farm to farm, very little is known. Why is it that such a small barrier as a wire fence may separate infected from clean land? The mystery here may be more apparent than real. It is known that the arrangements and sheep management differ in detail from farm to farm. Also, some people are prone to exaggerate losses, while others are quite reticent about them. Again, a number of lambs die on every sheep farm, and very few of them are opened and examined, and since the symptoms of lamb dysentery are most indefinite, mistaken diagnosis may frequently occur. Inquiry regarding the possible spread of lamb dysentery by rams has proved an exceedingly difficult and laborious business, and has never yielded any evidence to show that rams have the least influence in carrying the disease from farm to farm.

With regard to the older ewes which are annually drafted from the hills to lowland farms, it may be taken as con-

clusively proved that they do not carry the infection. Many of these ewes come from farms infected with lamb dysentery, and the annual sales give no indication that they are other than perfectly satisfactory animals.

Symptoms.—The symptoms shown by lambs affected with dysentery vary enormously. It is probable that there is only one definite symptom, and that is the passage of diarrhoeic fæces tinged with blood. Many lambs die from the disease that have never been observed to pass blood, but in nearly all cases where blood is seen in the fæces of a young lamb it may be taken as a sure sign of dysentery. In very acute cases nothing whatever may be seen wrong with the lamb, and in two hours it may be found dead. For these hyperacute cases death usually occurs in from three to five days after birth. As the disease becomes longer-established upon a farm, it tends to become subacute and certain symptoms are more easily seen. Affected lambs move stiffly, stop sucking, lie about, are dull and listless, and frequently stretch themselves. The passage of fæces appears to be accompanied by great pain. Many lambs show these symptoms under one week old, and they may linger for a day or two, but they almost invariably take the ground and are unable to rise. They soon become unconscious and die.

Chronic cases of lamb dysentery cause death in lambs up to fourteen days old, and occasionally up to four weeks old. Such cases are more common on farms where the disease has been present for a number of years. These lambs scarcely ever pass blood, and consequently they are often wrongly diagnosed. The abdomen of chronically affected lambs is often tucked up and has an empty look, and the lambs are usually found dead after an illness which may have lasted for several days.

It cannot be too strongly emphasized that in many cases lamb dysentery cannot be diagnosed by the symptoms alone. The only accurate way to diagnose the disease is by holding a post-mortem examination, and this may require the services of a veterinary surgeon.

Post-mortem Appearances.—As already stated, lamb dysentery is an affection of the intestines, and the post-mortem changes are usually confined to these organs. It is found, however, that the lesions vary considerably with the type of the attack and its duration. In very acute cases, where the illness has lasted only a matter of hours, the whole of the intestine from duodenum to rectum may be congested. The small intestine is usually intensely inflamed and full of dark blood-stained ingesta and clotted blood. The commonest condition is where both large and small bowel show numerous discrete ulcers and necrotic areas up to one-third of an inch in diameter, and with the typical hæmorrhagic

zone around them. Adhesions between pieces of bowel are common, due to the ulcers perforating the bowel wall, and forming an attachment to an adjoining loop. Another common lesion is where a length of several inches of bowel has been highly inflamed and has become necrotic. Again, it is very common to find cases where there are large areas of inflamed tissue ballooned out with small bubbles of gas.

The contents of the bowel vary with the condition. They may be practically normal to almost pure blood and necrotic debris. Attempts at healing are often noted in older cases with a subsequent constriction in places. Sometimes ulcers are found profusely discharging a yellow pus into the lumen of the bowel. Where gross ulcer formation has taken place the bowel is filled with a yellow, cheesy material. The other organs of the body usually show the appearance of toxic change.

Preventive Measures.—The medicinal treatment of affected lambs is impracticable. Even if it were practicable, the disease runs much too rapid a course to hope for any great success, and consequently measures directed against lamb dysentery must be preventive.

As a result of controlled field experiments which have been conducted on a large scale during the last three lambing seasons, *it can now be definitely said that lamb dysentery is a preventable disease.* Several methods may be adopted to this end, each of which has for its object the conferring of a degree of immunity on the young lamb against the toxin of what Dalling calls the "lamb dysentery bacillus." These methods have by now received a very extensive trial, and the experiments have been attended with considerable success. They will be considered separately.

(1) *The Use of L.D. Antitoxin in Lambs.*—The view has already been stated that the most certain way to prevent lamb dysentery is to inoculate newly-born lambs with a dose of L.D. antitoxic serum. This serum is prepared in horses by inoculating them with the toxin of the L.D. bacillus, when a serum of high protective value can be obtained. It is necessary to inject the lamb within twelve hours of birth, because if the inoculation is delayed too long after the lamb is born, the lamb dysentery infection may already have set in, and in such a case the inoculation will be without effect. The inoculations are performed with a hypodermic needle and syringe, and after a little instruction may be carried out by the shepherd while on his rounds. Some examples of the success which has attended this method of prevention may be noted here.

In North Wales, a controlled experiment was carried out in which 545 lambs on thirteen different farms were inoculated

soon after birth without any loss from lamb dysentery, while of 380 uninoculated or control lambs on the same farms, and born at the same time as those inoculated, 84 (22.1 per cent.) died.

On a Stirlingshire farm 618 lambs were born, and every alternate lamb born received a dose of serum, the remainder being allowed to go untreated to serve as a control. Altogether 320 lambs received serum, and 4 (1.25 per cent.) died from dysentery. The number of control lambs was 298, and of these 61 (20.5 per cent.) succumbed to dysentery.

These are but a few of the good results that have followed the use of serum when injected into newly-born lambs. From these results alone it is reasonable to conclude that the organism against which this serum is produced is an important factor in the causation of the disease.

(2) *Protection of the Lamb by Inoculation of the Ewe.*—The possibility of being able to immunize the lamb against lamb dysentery by inoculating the mother ewe was suggested to the research workers by a knowledge of what happens among other animals. For example, female guinea-pigs and mice when actively immunized will transfer a passive immunity to their offspring. Advantage was taken of this knowledge, and controlled experiments in laboratory and field have shown that ewes actively immunized with the toxin of the L.D. bacillus transfer a passive immunity to their lambs, which will resist the natural infection. This fact must not be regarded as evidence that lamb dysentery is a pre-natal infection. All our evidence goes to show that this is not so. It merely means that inoculation of the ewe is a convenient method of raising the resistance of the lamb to the toxins of the L.D. bacillus. In all probability the antitoxin passes from the ewe to the lamb, not *via* the blood stream before the lamb is born, but after birth in the colostrum or first milk secreted by the ewe.

This method of protecting lambs against dysentery has been employed upon a large scale in the border counties during the last three lambing seasons. In the earlier tests some accidents occurred, and it must be admitted that the vaccine for the ewes was not entirely harmless. Since that time, however, the vaccine has been considerably improved, and for the past two years the writer has not heard of a bad result. In order to produce active immunity in the ewe, two injections are required: the first is usually carried out in the autumn, shortly before the ewes are put with the tup;

the second is performed about one month before lambing. Experience has shown that the ewes may be conveniently and quickly injected by performing the inoculation on the washed under-surface of the tail. In some cases the two inoculations are performed in the spring of the year.

It has already been mentioned that, generally speaking, lamb dysentery in Northumberland had waned during the past two years, and a number of immunity experiments planned have had rather indefinite results, owing to the insignificant difference in the death-rate of lambs born from inoculated and control ewes. Details must be given, however, of one experiment showing an enormous difference in the death-rate, which it is only fair to ascribe to the vaccination of the ewes. On 13 farms, 2,330 ewes received two inoculations with the vaccine, one in the autumn and the second in the spring. These ewes gave birth to 2,651 lambs, of which 62 (2·3 per cent.) died from dysentery. Upon these same farms, 1,057 ewes were left untreated. They gave birth to 1,231 lambs, of which 227 (18·4 per cent.) died from ascertained dysentery.

Although two injections of the vaccine are required actively to immunize ewes, the latest results show that two injections are not required each year. Provided ewes have had two inoculations, their immunity can be maintained in subsequent years by a single inoculation performed in the spring and given preferably one month before lambing is due to commence.

(3) *The Use of Injecting Serum into Ewes.*—Still another method of producing immunity in lambs against dysentery has been tried. It was thought that if a homologous antitoxic serum, *i.e.*, one made from ewes, were injected shortly before lambing, the passive immunity which would result in the ewes would be transferred to the lamb in the colostrum or first milk secreted by the ewe. It is well known that the immunity which results when serum is used is passive and lasts only a short time, probably not longer than four weeks, but by inoculating the ewes within one week of lambing an endeavour was made to include parturition, and until the lamb was two weeks old, within the effective time limit of the serum. The writer took charge of a field experiment designed to try out this method under natural conditions, and from the results obtained came to the conclusion that the method may be usefully employed under certain circumstances. For example, on farms where the disease begins to show itself in the midst of

lambling, the owner may check the loss by inoculating the lambs with serum soon after they are born. He may also attain the same result by inoculating all the unlambed ewes with homologous antitoxic serum. This operation is followed by no ill effects on the ewes, and it seems certain that this method of preventing lamb dysentery may be used with confidence where circumstances permit.

Besides these specific methods of preventing the disease, a knowledge of the nature of lamb dysentery makes it evident that strict attention should be paid by farmers and shepherds to hygiene and sanitation throughout the lambing period. Immediately a living case is encountered it should be killed and burnt, and lambs found dead should be buried as soon as possible. It is not advisable to open lambs after a diagnosis has been established, as the disease germs are apt in this way to be spread over the pastures. The practice of skinning the dead lamb and using it for the purpose of "twinning" another lamb on the ewe should be discontinued. It may be a great aid in persuading the ewe to take to the lamb, but it is unhygienic, and must tend to spread disease producing micro-organisms. The shepherd's hands should be disinfected and a reliable oily disinfectant must always be carried by the shepherd. (A good dressing is composed of creosote, 1 drachm ; olive oil or rape oil, 8 oz.) A tub of Lysol or Jeyes' Fluid of suitable strength should be kept at the house, and the shepherd's boots, implements, etc., should be freely disinfected on returning from the hill. Shedding-in the late lambing ewes must be postponed as long as possible, and in cases where it can be done it should be discontinued altogether.

Summary and Conclusions.—(1) Lamb dysentery is caused by the toxin of a specific organism, which has been named the "L.D. bacillus." It is similar to, but not identical with, *B. welchii*.

(2) Lamb dysentery may now be classed as a preventable disease.

(3) It can be prevented by the following methods :—

- (a) By inoculating newly-born lambs with an antitoxic serum prepared from the L.D. bacillus.
- (b) By the double inoculation of ewes with toxin antitoxin mixture prepared from the L.D. bacillus.
- (c) By the single inoculation of pregnant ewes close on lambing with homologous L.D. antitoxic serum.

(4) The attention of farmers and shepherds is directed to the necessity of maintaining conditions of good hygiene and sanitation throughout the lambing season.

THE TRAINING OF THE VETERINARY SURGEON

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SOME years ago, a farmer client asked a veterinary practitioner of my acquaintance : " Can I send my son to you for a few months ? I want him to become a ' vet ' ! " Probably quite a number of veterinary surgeons have had such a question addressed to them ; but I doubt whether any medical practitioner has been expected to qualify a client's son as a doctor by a few month's instruction.

The incident is illuminating as an indication of rather widely-spread ideas about the training needed to become expert in the treatment and prevention of diseases in animals, a matter in which the general public would seem to need educating. It does not, even at the present day, recognize that disease, whether of animals or man, is governed by the same causes, requires the same amount of study, and like measures of prevention and cure ; still less does it realize that animals, as regards their health and hygiene, are subject to the same rules as human beings. Indeed, with good reason, it can be claimed that a veterinary surgeon must devote more time and energy than a doctor to make himself efficient. The doctor has only the human being to study and seldom devotes time to a consideration of comparative pathology, whereas the veterinary surgeon to-day must be skilled in dealing with horses, cattle, sheep, pigs, dogs and poultry, and is, moreover, very often a student of human diseases as well. His training compels him to think in terms of comparative pathology, and this involves comparison with human ailments in addition to the study of all the species with which he is directly concerned. A moment's thought will show that the veterinary surgeon has not only to study disease in all these diverse species but that he must also be versed in their hygiene, nutrition, management, and physiology.

The veterinary art is probably as old as the medical. The latter profession sprang from the old barber-surgeon, the former from the shoeing-forge ; but when the medical man separated himself from the barber's business, he dropped the barber's pole, the symbol of the bloodstained bandage, whereas the veterinary surgeon, when he left the shoeing trade, took the symbol of the horse-shoe and put it on his Common Seal, on which it still persists. Two thousand years before Christ, the

Assyrians had laws relating to both veterinary and medical practitioners, and the scheme of things then prevailing was evidently that of payment by results, because not only was a scale of fees laid down but there was a scale of fines to be imposed when the treatment was unsuccessful. Yet, although the age of the two professions may be about the same, their progress in Britain, at any rate, shows a marked difference. One has been encouraged, the other neglected, yet it is beyond question that the neglect of veterinary science has hindered the progress of medical science.

Development of Veterinary Schools.—To judge the progress of veterinary science, regard must be had to the history of the development of veterinary education. Before 1762, there were no veterinary schools in existence. In that year, the school at Lyons was founded, and two other schools in France were opened later. By 1800, there were about a dozen schools in Europe. The first in Britain was that now known as the Royal Veterinary College, London, founded by a Frenchman named Sainbel, in 1791, about thirty years after the Lyons School. Here the first examination was held in 1794. A second British college was founded by Dick, in 1823, at Edinburgh—the present Royal (Dick) Veterinary College. The year 1859 saw another College started at Edinburgh, but in 1904 this was transferred to Liverpool as part of the University there. Another college was opened at Glasgow in 1862, and the Dublin College was started in 1900. There are thus five veterinary schools in the British Isles at the present time.

It is to be noted that only one of these five began as a State institution. The other four were private ventures and continued as such until quite recent years, when State support was forthcoming to a limited extent. They depended for their existence on the fees of students and, until recently, endowments were conspicuous by their absence.

Early Mistakes.—Regarding the tragic mistakes at the outset of veterinary education in this country, mistakes which have dogged the profession up to the present day, I cannot do better than quote from *Early History of Veterinary Literature and its British Development*, by the late Major-General Sir Frederick Smith. "The English School," he says, "began badly by losing its Principal, Sainbel, two years after his appointment and, immediately after, its powerful supporter, John Hunter. The successor to Sainbel (Professor Coleman)

was not a veterinarian but a surgeon, nor did he know anything of the veterinary art. In this extraordinary state of affairs, it is difficult to realize how the Veterinary College functioned or how it was possible for the examination board, composed of the masters of medicine, surgery and chemistry in the Metropolis, to certify to the knowledge of candidates in a subject of which they were as ignorant as the Principal of the College."

Coleman restricted studies to the horse and resisted all attempts to introduce the study of other quadrupeds, so that "later, when, under free trade, diseased foreign stock were admitted among our clean herds and flocks and filled the country with epizootic diseases, there were none who understood them." "Behind Coleman there stood the Governing Body directed by Sir Astley Cooper, his life-long friend, who defended him against all attacks. Every attempt to relieve the College of its medical character and convert it into a veterinary institution was strenuously opposed from within."

There can hardly be a doubt that if our veterinary profession suddenly ceased to exist, disaster would quickly overtake the whole live stock industry of this country. When cattle plague came to Britain in 1865, the Government of the day refused to put into operation the measures advised by veterinarians, and the loss to the country was some five millions sterling, a large sum for those days. Eventually, the Government was compelled to adopt the measures recommended in order to get rid of the disease. In the outbreak in Belgium in 1920 the conclusion was reached that rinderpest (cattle plague) is a comparatively easy disease to control and stamp out if a properly organized veterinary service is in existence. Continental countries were quicker than Britain to perceive the advantage to the State of the encouragement of veterinary science, and, five or six years ago, it was true to say that the Governments of France and Germany gave more money in one year for veterinary education than Britain had given over a period of a hundred years.

Progress.—Our State neglect of veterinary science has, fortunately, come to an end during the last few years, and grants, which we cannot yet say are adequate, have been provided by the Government both for education and research. Such an upheaval as the Great War was needed to bring about the change. Nevertheless, we are suffering, and shall continue to suffer for some years, for the long period of neglect. The profession had come to be regarded as of such poor standing that it failed to attract men of the standard of general educa-

tion required for the other learned professions. The result is that the present increased demand for men able to take up new posts, created with the object of controlling animal scourges both in this country and other parts of the Empire, cannot be met. There are seldom more than six applicants when posts of £400, £500 or £600 a year, or more, are advertised—posts which carry very good prospects of advancement. This difficulty will no doubt resolve itself in time, as the result of the advertisement which the profession is now receiving in so many quarters—not least from prominent men in Government circles.

The general trend in all the veterinary colleges is an upward one. These institutions are now able to train men in a fashion undreamt of a few years ago. Modern premises are slowly replacing the old ruins, and modern equipment is fast being installed where before it was almost completely absent. The older men on the teaching staffs, who did such splendid work under such heartbreaking conditions, and who carried on year after year on a miserable pittance simply from love of, and interest in, their subject, are giving way to younger men whose enthusiasm has not been damped by continual disappointment. A better type of man is entering the colleges, one with a finer ground-work of general education, but whether such men are entering in sufficient number is still open to doubt.

Perhaps the most hopeful development is the tendency of the colleges to seek a closer association with the Universities, for until this association of the veterinary student with those for other professions becomes much closer, the veterinarian will continue to be regarded as distinct from other educated men. While veterinary students are segregated in their own special institution throughout their whole professional course, and as long as one does not come in contact with them at the Universities, so long will other professions and the general public rank the veterinary profession as outside the general scheme of things. Fortunately, where the veterinary student has had the opportunity to show his comparative prowess, he has not suffered by the comparison, but those with knowledge of the working of the two systems are in no doubt whether a university or a non-university education is the better for him. Let there be no delusion, however, concerning the difficulties confronting veterinary science before it secures recognition inside any of the universities; yet who is not the better man for having to fight for recognition of the science to which he has devoted his life?

In veterinary science we have a subject second to none for absorbing interest and for the value of its achievements to the country. Veterinary and medical science derive mutual advantages from association in the same institution. Further, the medical undergraduates, through this propinquity, come to appreciate the amount and variety of training required to make a veterinarian, and are less likely, in after life, to trespass in a province for which they lack the knowledge and special training required.

Since the beginning of the century, the progress made in veterinary education has been amazing, and for this remarkable advance the veterinary profession can take to itself almost all the credit. It has progressed in spite of the disadvantages under which it has suffered. The prospects for the future, therefore, are all the brighter now that State support for education has been secured.

Veterinary Training.—The Royal College of Veterinary Surgeons came into existence in 1844, by Royal Charter, which recognized the veterinary art as a profession, and the thousand or so graduates from the schools as Members of the R.C.V.S. The College is not a teaching institution, but conducts examinations of students from the affiliated schools, grants diplomas, and deals with registration and discipline. It is the one portal of entry in the British Isles to the veterinary profession. In 1876 the Fellowship Diploma was instituted. In 1892 a preliminary examination in general education became compulsory; and in 1914 the Diploma in Veterinary State Medicine (D.V.S.M.) was instituted. All this was effected by Royal Charter. An Act of Parliament of 1881 protects the title of Veterinary Surgeon, but does not prohibit unqualified practice. An Amendment Act, in 1920, gave power to collect an annual fee of one guinea from members.

The prospective veterinary student has a choice of examinations in general education. Those who are determined to get on are well-advised to pass a university matriculation examination in order that they may take a university degree in veterinary science. The degree courses run concurrently with the diploma course. The latter requires four years' study, the degree five years'. The diploma constitutes the only licence to practise, but the degree gives a distinction and marks a man as having done better than the average. It was in 1895 that the three years' course of professional study was changed into a four years' course, at which it now remains. The Council of the Royal College of Veterinary Surgeons has resolved to extend

the course of instruction to five years; the new regulations will come into force in August, 1931.

It has never been claimed, of course, that the four years' course is sufficient to turn out specialists in any line of veterinary work. All that it can do is to give the student a good grounding in professional knowledge of a general character, such knowledge resting on a foundation of instruction in pure science subjects. In the first year, chemistry, physics, botany and zoology are studied, and veterinary anatomy commenced; in the second year, anatomy is completed, and physiology, histology and the handling of animals are taken up; in the third year, pathology, pharmacology and hygiene form the subjects of study; while the fourth (final) year is devoted to veterinary medicine, veterinary surgery and obstetrics.

This gives the curriculum in barest outline, but, in actual fact, most of the subjects include many branches of study. In America, it is customary to detail all the "ologies" taught, and a formidable list they make, but while the British course does not resort to so much "window dressing," the same instruction is embodied in it, and the examinations are a safeguard against any omissions.

After such a course of study, the successful candidate is considered to have received sufficient ground-work to practise as a veterinary surgeon, since practice, in which he will remain all his life, constitutes his further school of instruction, and it is experience that will give him skill in his profession.

Should the student wish to specialize in veterinary state medicine, or in research, he must receive additional training. The university degrees provide extra training in chemistry, biology, etc., which are useful to the research worker. The Diploma in Veterinary State Medicine gives that amount of post-graduate training which fits men to become veterinary officers in Government services, or for posts under county and municipal authorities. Further post-graduate training in veterinary pathology and bacteriology may be obtained by taking special courses in these subjects. Post-graduate courses in tropical veterinary medicine will, it is hoped, be again available in Britain in the not too distant future; they are essential for men proceeding to the tropics.

With advances in knowledge, there is now increasing difficulty in getting all the instruction necessary for the Diploma within the compass of the four years' curriculum. Pathology and bacteriology have expanded into an enormous field, and it is almost impossible to get through such a subject as the con-

tagious diseases of animals in one year. Anatomy is a subject which shows little change and yet, for a long period, two years have been conceded for instruction in it. To think, too, that the whole of veterinary medicine and surgery can be taught in one year is absurd.

It is now necessary to put in nearly six years in order to obtain a degree in human medicine at a university. This will emphasize the difficulty experienced in crowding all the veterinary subjects into four years and ensuring that the instruction shall be essential, practical and adequate.

There is no compulsory pupilage for the veterinary student. It is, however, imperative that he should take every opportunity during vacations to study actual practice with a veterinary surgeon, no matter what branch of the profession he contemplates taking up. A recently-qualified man, intending to devote himself to research work, told me: "I would not go into practice for a thousand a year." One can hardly conceive a more foolish point of view for a future research worker, who should be able to visualize the work of various kinds of veterinary practice, and become acquainted with the difficulties the practitioner has in dealing with disease. No research worker will ever be the worse for spending one year, or possibly two, in general practice after graduating. The same remark applies to holders of the D.V.S.M. who propose to go in for a public appointment.

Openings for Students.—There are many fields of work open to the veterinarian. The majority of graduates are in general practice, over which the advent of the motor car has brought a remarkable change. Horse practice has now declined until it is almost negligible, but new avenues have opened up. Cattle practice has expanded, and the veterinary surgeon is consulted about the ailments of other species of animals with which he was seldom called upon to deal in the past. Veterinary science has developed so rapidly that some veterinarians can be found, no doubt, who have not kept pace with it. The demand for the services of veterinarians will be in direct ratio to the public conception of their ability to do the work for which they are licensed. The colleges are changing with the times, although one sometimes wonders whether the change is sufficiently rapid. Education is now given in such subjects as diseases of sheep and poultry, considerable attention being given to both, whereas, a few years ago, these subjects were almost entirely neglected. The need for the services of veterinarians has not diminished,

but whether they will be utilized depends in great measure on the profession itself.

In veterinary public health a great work lies before the veterinarian, and his services are being sought in increasing degree by county and municipal authorities. The inspection of meat and milk furnishes one useful field of work ; and, sooner or later, the great problem of bovine tuberculosis in Britain will have to be tackled, in which work the veterinarian must take the lead. In many parts of the country, where the veterinarian has been proving his worth in work of this kind, local authorities must be wondering how they managed in the past without him.

The Veterinary Service of the Ministry of Agriculture in Britain is an essential service. The pay and prospects have not long since been improved, but few would be found to maintain that they are even now commensurate with the services rendered to the country. The work of these Officers lies in controlling scheduled epizootic diseases and in preventing the entry of fresh diseases from other countries into these islands.

The work of the Royal Army Veterinary Corps needs no eulogy. During the War, the services rendered to the country were beyond all praise.

In the Colonies an excellent career is open to the veterinarian, and his position and prospects are likely to be improved in the near future. The self-governing Dominions, however, have now started their own veterinary schools and veterinary services, and the field for British graduates is all but closed.

I am often asked whether I would recommend the veterinary profession as a career for a boy, and the answer must always be that it depends on the boy. Given a love for that kind of work, there is no finer profession. Fortunes are not made, but everyone's ambition does not lie in that direction. The veterinary profession has no use for slackers, but there is plenty of room near the top.

Let the boy matriculate, let him get the best possible training in the general sciences, let him take a degree as well as the diploma, let him continue his studies as a post-graduate student at the earliest opportunity, and a successful career is open to him. I once heard a very distinguished veterinarian from abroad, a man of world-wide reputation, say : " I have always been proud of the fact that I am a veterinarian, and I simply do not understand all this talk in England of inferior status and so on." The inference of inferior status depends partly upon the men themselves, but is probably mainly due to

official discouragement. It has been my lot to travel extensively in various parts of the world, but in no other country visited, except, perhaps, the United States, is the veterinary profession in quite the same position that it has so long occupied in Britain. There is no reason why it should not be recognized as the equal in status of the other professions. In my opinion, it is largely a question of education, and with the coming of State recognition in so many forms, and the steady rise in the standard of education, the time will soon come when the veterinary art can no longer be regarded as the Cinderella of the professional world.

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SOME RECENT INVESTIGATIONS INTO SUGAR BEET PROBLEMS *

II—METHODS OF ANALYSIS

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VARIOUS difficulties have arisen in the last few years regarding the methods of analysis employed by the beet-sugar factories to determine the sugar percentage in deliveries of beet by farmers. The fact that payments are made on the results of analysis has led to a considerable controversy as to the accuracy of the methods employed. It is, of course, essential that, for the sampling of deliveries, the process adopted shall be one which can be carried on without interfering with the reception of consignments. Thus, the alcohol extraction method, accepted for so many years as the most accurate (although it is possible, in view of recent work, that this blind confidence is not entirely justified), is out of the question owing to the lengthy manipulation required for accurate results. When the beet-sugar industry started, a series of conventions was adopted by factories and growers in which the methods of sampling were laid down, and the cold water extraction method was used for the analytical determination of the sugar. At experimental centres where work on sugar beet was carried out, it was felt that the analytical methods adopted should be similar to those employed by the factories, but it was apparent that the sampling methods pursued were open to criticism.

* The first article appeared in last month's issue of this JOURNAL.

The factory procedure was, in theory, to select 50 beets at random from each delivery, to use these 50 beets for the dirt tare, to size them and select every 5th beet. The ten beets so selected were rasped and the pulp obtained used for the determination of sugar. This procedure is open to the objection that there is no check on the method of selection from bulk deliveries, and unless very great care is exercised the 50 beets selected may not be representative of the bulk delivered. In practice a smaller number is sometimes selected. This difficulty was overcome by selecting samples from a field by walking down the rows and taking every n th beet along a given length of row; a large number of check experiments have demonstrated the practical efficiency of this method. The grading into sizes of the 50 selected beets, and the selection of every 5th beet, demands a certain amount of care, which in the rush of work at the factory may not be very carefully carried out. In any case, ten is too small a number to ensure a really representative sample.

In the experimental work, 50 beets were taken and a pulp sample removed from each. With very great care a well selected sample of 25 beets appeared to give reasonable results, but a sample of 50 beets may be considered as the minimum number for routine work.

Methods of Obtaining Sample Pulp.—In the last two or three years, owing to the multiplication of factories and the increased interest taken by farmers, friction has arisen because of discrepancies in results returned from some factories in connexion with the sugar content. The returns of one factory may be either consistently higher than another or, whilst the average return is the same, may show a much wider variation.* One of the difficulties met with at the three centres concerned with the present investigation has turned on these discrepancies, and at one centre, which had the advantage of easy communication with a factory, a considerable amount of work was carried out with the co-operation of the factory to determine the point in the various processes at which errors might conceivably occur. A number of experiments were designed to compare the standard methods of obtaining pulp and the different polarimetric methods used in estimating the sugar content. Three methods are in

* Report No. 9 Farm Economics Branch. Camb. Univ. School of Agriculture, 1927.

common use to obtain a fine and representative pulp from the beet: the circular saw, the rasp and the Sans Pareille press.

- (i) *The Circular Saw*.—This consists of a circular saw, generally about 16 inches in diameter and one-sixteenth of an inch in thickness, running at one thousand revolutions per minute. It is so driven that it rotates away from the beet and not towards it. The crown of the beet is presented to the saw and a section is taken lengthwise from crown to tail, the resulting fine pulp being collected in the hopper below. Each beet in the sample is treated in this way, and the pulp obtained is thoroughly mixed by stirring with a rod or spatula.
- (ii) *The Conical Rasp*.—This is a circular disc, the rasping edge of which is designed to section the whole length of the beet. The rasp revolves on a central spindle at about 350 revolutions per minute, and the beet is pressed on to the top edge of the rasp which cuts out a wedge-shaped sector from the tail to the crown of the beet, the pulp falling into the hopper as in the circular saw method. The number of teeth on the rasp varies, the old standard rasp having 26 teeth to the square inch. A 40-tooth rasp is quite common, and a 60-tooth rasp has been used and has now been adopted as the standard cut in future. The standard number of teeth is controversial, and rasps up to 300 teeth per square inch have been made. It is alleged that the pulp obtained from the finer rasps allows of more perfect extraction by water. Finer rasps must be driven at a higher rate of speed than coarser ones and as a matter of practical manipulation rasps with a tooth number between 26 and 60 appear to be the more satisfactory. On the average the pulp from the 60-tooth rasp gives 0.21 per cent. more sugar than that obtained from the 26-tooth rasp. A microscopic examination of the pulp showed that, in each case, the soft ground tissue was thoroughly broken up, but pieces of the fibro-vascular bundles were found in both, and were approximately of the same degree of coarseness.
- (iii) *The Sans Pareille Press*.—This is a powerful press worked by a hand screw. The instrument will grind up comparatively large pieces of beet into a very fine pulp without the loss of juice. It is extremely suitable for obtaining pulp from individual beets when it is required to pulp the whole root.

At one centre these three methods were compared and the following procedure was adopted. A sample of pulp was obtained from individual beets by the circular saw and by the rasp. The remainder of the beet was pulped up by means of the Sans Pareille press. The sucrose present in each of the samples was then determined by the Sachs-le-Docte process. Results of these investigations are shown in Table IX.

The data indicate that there are slight differences in the sugar content returned from pulp obtained by the three methods, but on the whole the results are concordant and demonstrate clearly that pulp obtained from each of these

TABLE IX
Percentage sucrose obtained

Series	Circular Saw per cent.	Pellet Rasp per cent.	Sans Pareille per cent.
1 ..	17.31	17.31	17.31
2 ..	19.16	19.10	19.10
3 ..	—	17.71	17.71
4 ..	20.65	—	20.70
5 ..	19.37	—	19.37
6 ..	18.68	18.68	18.68
7 ..	17.39	17.40	17.40
8 ..	—	19.13	19.14
9 ..	—	17.40	17.42
10 ..	20.88	—	20.90
11 ..	19.27	—	19.27
12 ..	19.12	19.14	19.13
13 ..	18.64	18.64	18.70
14 ..	—	17.31	17.31
15 ..	19.91	19.91	19.91
16 ..	19.26	—	19.25
17 ..	18.39	18.39	18.41
18 ..	—	17.40	17.40
19 ..	19.27	—	19.27
20 ..	18.39	18.41	18.45

methods gives practically the same diffusion with water. In routine analysis, where a large number of beets have to be sampled, the press method is too tedious. The saw requires less attention than the rasp and is easily cleaned, and if a true longitudinal section is ensured the method appears to be quite satisfactory. The rasp gives an excellent pulp; a fair quantity is obtained from each beet and if care is exercised in cutting down to the centre of the root the proportion removed is a true fraction of the entire root, whereas in the saw method a flat section of definite thickness is removed through the root.

Table X shows the comparative unimportance in routine work of the time factor in carrying out cold water diffusion on sufficiently fine pulp as obtained from rasp or saw.

TABLE X.—SUGAR IN PERCENTAGES

Series	Thirty seconds shaking	Five minutes shaking	Thirty minutes shaking
1	19.92	19.88	19.88
2 } (a) {	18.98	19.13	19.25
3 } {	19.45	19.21	—
4 (a)	19.77	19.52	—
5 } (b) {	17.18	16.87	
6 } {	16.94	16.96	
7 } (b) {	17.12	17.13	—
8 } {	17.45	17.48	—

(a) Light land beet

(b) Fen beet.

Methods of Estimating Sugar Content.—The methods in practice of estimating the sugar in the pulp may be classified under three main headings (a) expression of juice, (b) alcoholic extraction, and (c) diffusion.

(a) *Expression of Juice from the Pulp.*—This method consists essentially of squeezing the beet pulp in some form of press, and has been widely employed in the past. The extraction of juice from the beet tissue by pressure is not only extremely tedious but is open to so many serious objections that the method was not examined in detail. For comparative determinations of the sugar in such watery material as mangold juice, extraction by pressure has been used and found to be satisfactory, but with the high sugar content of beet the difficulties of extraction by pressure become insuperable.

(b) *Alcoholic Extraction.*—This method has been described as the scientific process *par excellence*, and for some time complete reliance has been placed upon it. Recent work has shown that errors may easily arise owing to the number of manipulations required, and its use as a routine method is both costly and tedious. The objections raised against the method are that it involves the use of heat and that there is a possibility of the solution of dextro-rotatory hemicelluloses. Errors may also arise from the filtering process, differences in temperature volumes, and the difficulties of obtaining a rapid and accurate reading of the rotation in the saccharimeter. Two methods of extraction were adopted:—

- (i) 52 grammes of fine pulp were placed in a Soxhlet extraction apparatus, 3 c.c. of lead subacetate solution added, and then 150 c.c. of 90 per cent. alcohol. The material was digested in a water bath for 20 minutes, after which time the volume was made up nearly to the mark with 90 per cent. alcohol. The flask was returned to the water bath for another 20 minutes, and then cooled to room temperature and the volume made up to the mark with 90 per cent. alcohol. The solution was then thoroughly mixed, filtered and polarized in a 200 mm. tube.
- (ii) 26.05 grammes of the pulp were weighed out, 3 c.c. basic lead acetate added and the mixture stirred thoroughly. The mixture was then washed into a Soxhlet apparatus with about 150 c.c. of alcohol. The extraction was continued until no sucrose could be detected in a drop of the alcohol by the alpha-naphthol test. The pulp was washed with a little warm alcohol and the flask cooled to standard temperature, made up to the mark with alcohol, thoroughly mixed by shaking, and a clear solution obtained by filtering. The filtrate was run into a 400 mm. tube, allowed to stand in the saccharimeter for 20 minutes and the rotation read in the ordinary way.

(c) *Diffusion Processes*.—There are three routine processes in ordinary use, each of which is claimed to be satisfactory.

THE PELLET HOT DIGESTION METHOD.—This process has been recommended for adoption in all cases where it is impracticable to obtain a fine pulp. In laboratories where only occasional samples of beet are dealt with and commercial routine apparatus is not available or where a check method is desirable, the Pellet hot digestion method is suitable. It can be employed on the coarse pulp obtained by an ordinary meat mincer where instantaneous diffusion methods are impossible. The procedure is: 26 grammes of mixed pulp are weighed out on an onion skin paper and transferred to a Kohlrausch wide mouth flask graduated at 200.6 c.c. Lead subacetate solution (5.7 c.c.) is added until no further precipitate appears by the "streak" method—care being taken to avoid excess of the solution, as it has been found that lead subacetate in hot solution forms a laevo-rotatory combination with certain constituents of beet pulp. The flask is filled to within an inch of the mark with hot water and the whole immersed in a water bath at from 80-85° C. for half an hour, being shaken during this period at intervals to disengage the air bubbles. At the end of half an hour the flask is removed from the water bath and allowed to cool down to a temperature of 20° C. A few drops of ether are added to break the foam and the volume completed. After thorough mixing, the solution is filtered and polarized in a 200 mm. tube. It is found necessary in some cases to add a drop of glacial acetic acid to the filtrate in order to clarify it.

THE KRÜGER AND SACHS-LE-DOCTE COLD DIGESTION PROCESSES.—These are the two methods in common use in beet-sugar factory and other laboratories throughout the world; they have been the subject of much controversial matter in the scientific press. Both processes consist of digesting the beet pulp in the cold. With the Krüger process the quantity of pulp to be taken is governed by the volume of the pipette used. The actual quantity used is one-third of the volume of the pipette, e.g., volume of pipette=78 c.c., then 26 grm. of pulp are taken on the assumption that the weight of juice in 26 grm. in an average beet of 5 per cent. marc is $26 \times 0.95 = 24.7$ grm., and the specific gravity of average beet juice is nearly 1.07, so that the volume of juice in the normal weight (26 grm.) of pulp is $24.7 \div 1.07 = 23.08$ c.c. The amount of water necessary to complete this volume of juice to 100 c.c. is $100 - 23.08 = 76.92$. The ratio of normal weight to volume of water added is 26 grm. to 76.92 c.c. or 1 grm. is equivalent to 3 c.c.*

It is claimed in favour of the Krüger process that it is simple and rapid, the pipette is not of a fixed definite volume and there is no need to employ counterpoised capsules of the same weight and requiring a cover to effect the admixture. While it is admitted that the process is not extremely accurate it is recommended as being sufficiently so for use in factories, seed-testing stations, etc., where a large number of determinations have to be made in a minimum time. Many objections have been raised to the method, particularly by le Docte (one of the originators of the Sachs-le-Docte process), chief among which may be mentioned:—

- (a) the use of irregular weights for each individual pipette;
- (b) the use of insufficient water to allow for complete diffusion;

* Browne: *Handbook of Sugar Analysis* (pub. Wiley).

- (c) the error involved in taking a weight of pulp equal to one-third the volume of the pipette, irrespective of sugar content and varying density of the juice.

In the Sachs-le-Docte process these difficulties have been overcome by taking a definite quantity of pulp (26.05 grammes) and adding a constant volume of water (177 c.c.). The process involves the use of counterpoised tin-lined capsules with rubber covers to permit of vigorous shaking. The mixture is rapidly filtered and the sugar polarized in the ordinary way.

For the purpose of comparing the Krüger process with the Sachs-le-Docte method and also with the other methods previously mentioned, the details of analysis given by Browne* for each method were followed. Pulp was obtained by means of the Sans Pareille press and portions were examined by the various methods in quadruplicate. The results obtained are set out in Table XI.

TABLE XI.—COMPARISON OF STANDARD METHODS OF SUGAR BEET ANALYSIS

Series No.	Sachs-le-Docte Sucrose per cent.	Krüger Sucrose per cent.	Pellet Hot Digestion Sucrose per cent.
1 (a) ..	17.31	17.40	17.39
(b) ..	17.31	17.41	17.40
(c) ..	17.31	17.10	17.40
2 (a) ..	19.16	19.14	19.13
(b) ..	19.10	19.43	19.14
(c) ..	19.22	19.15	19.14
3 (a) ..	17.71	15.37	17.40
(b) ..	17.71	15.40	17.42
4 (a) ..	20.65	21.46	20.88
(b) ..	20.65	21.17	20.88
(c) ..	20.88	20.88	20.90
5 (a) ..	19.37	19.43	19.27
(b) ..	19.37	19.39	19.27
6 (a) ..	18.68	19.14	19.12
(b) ..	18.68	19.15	19.13
(c) ..	18.68	19.17	19.14

Table XII shows the results of some comparative tests with the Sachs-le-Docte method and the alcohol extraction carried out on the same sample of pulp.

TABLE XII		
Sample No.	Sachs-le-Docte	Alcohol extraction
1 } (a) {	17.5	17.8
2 } {	18.4	18.1
3 } {	19.1	18.9
4 } (b) {	15.8	15.7
5 } {	14.8	15.0
6 } {	16.9	17.0
(a) Light land beet.		(b) Fen beet.

* *Loc. cit.*

Observations on the Results.—The data indicate that with the Sachs-le-Docte and Pellet hot digestion methods comparable sugar percentages are obtained from the same sample of pulp. The Krüger process gives results in which the error between individual samples makes its use in routine practice open to criticism.

Of the methods which have given comparable results, the Sachs-le-Docte process is more convenient to the routine sugar analyst owing to its simple manipulative details and the rapidity with which a large number of samples can be examined.

In comparing the two methods generally adopted in sugar beet laboratories (*i.e.*, the Sachs-le-Docte and Krüger processes) the results obtained in the investigation under review fortify the criticism raised by le Docte against the Krüger process, and the Sachs-le-Docte process appears to be the more reliable.

The alcohol method and the Pellet hot water method have the advantage that it is not necessary to obtain a fine pulp, as the temperature in the case of the Pellet and the alcohol in the case of the alcohol method facilitate extraction from a coarsely ground sample.

(*To be concluded.*)

* * *

POULTRY KEEPING IN A HUNTINGDON-SHIRE ORCHARD

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THE practice of poultry keeping, when given a definite rôle in the general farm economy, should appeal in many ways to the fruit grower. There is no doubt that the production of the commercial egg and table bird must, and always will be, the chief source from which a profitable return can be gained from the capital invested. It ought not, however, to be forgotten that there are other reasons for which poultry keeping can be looked upon as an attractive and profitable undertaking. To mention in this connexion just two such reasons, we have the production of poultry manure, and the birds' natural habit of devouring insects in the several stages of their metamorphosis.

With regard to the first of what might be termed secondary advantages—the production of manure—the fruit grower finds that one of the most expensive, and at the same time

necessary manures, is composed of nitrogenous matter, and considerable sums can be expended in this direction in a single season. The hen, although a small animal, is capable of producing a large quantity of manure of a highly concentrated nature: so concentrated, in fact, that farmers have to use it with care and discrimination, otherwise a laid crop would result from an overdose of nitrogen. The fruit grower, whose trees when in full crop remove from the soil large quantities of chemical foods, endeavours to return these materials in some way in order that the fertility of the soil may be maintained at a high level. Poultry manure enables him substantially to achieve his object without incurring excessive expenditure.

In the destruction of insect pests and the eradication of weeds poultry may be relied upon to play a very useful part. It is not suggested that they are capable of keeping the orchards entirely clean, but there is no doubt that they make the control of these pests very much easier than it otherwise would be.

The Orchard.—The fruit farm that forms the subject of this article is owned by Mr. W. W. Tebbutt, and covers some 11 acres of land situated on the approach to the small village of Bluntisham, Hunts, about 4 miles from St. Ives.

The orchard consists of mixed fruit, the chief crop being plums, for which the soil, a stiff clay loam, seems eminently suited. The major portion of the ground under the fruit trees is cultivated, but a small part forms a grass orchard where chickens are reared. This arrangement is admirably suited to the system of poultry keeping that is followed, for the grass part of the orchard is kept solely for chicken raising, the ground being well limed and allowed to rest when unoccupied during the autumn and winter months. On the cultivated portion of the orchard about 500 birds are kept—after the removal of the crop—for egg production. The breeds that appear to thrive best on this heavy soil are Rhode Island Reds and White Wyandottes. These dual-purpose birds, especially the Rhode Island Reds, give Mr. Tebbutt a good egg yield, and while perhaps not of the standard of production of the White Leghorn, at the same time have the added advantage of producing cockerels which can be sold at a profit for table purposes.

The birds are split into two flocks, one of White Wyandottes and the other of Rhode Island Reds, which, although separated by wire netting, have an extensive range over the

cultivated portion of the orchard. During the season over 2,000 chickens are reared on the grassed part of the orchard.

Hatching and Rearing.—All possible care has been taken to establish an efficient system of incubating eggs and rearing chickens. Hot air incubators of small capacity (150 to 200 eggs) housed in a special shed are relied on to carry through the hatching operations, which commence in late December. The reason for making such an early start is that it enables the comparatively small incubator accommodation to be used to its full extent. On hatching, the chicks are transferred from the incubators to a small brooder house which is capable of holding up to 600 chicks.

The question of the type of brooder and system of brooding presents problems of no small importance to the farmer, for the factor that contributes most to the ultimate success of the farm is unquestionably his ability to rear healthy chickens. One cannot dogmatize on systems of brooding, for it is safe to say that there is no best system. The problem on this farm has been well thought out both from the point of economy in capital expenditure and as a successful rearing unit. The brooder house is a converted barn, originally erected for the storage of fruit, but now made to serve in a dual capacity. During the late winter and spring months it is used as a brooder house, and for the remainder of the year as a fruit store.

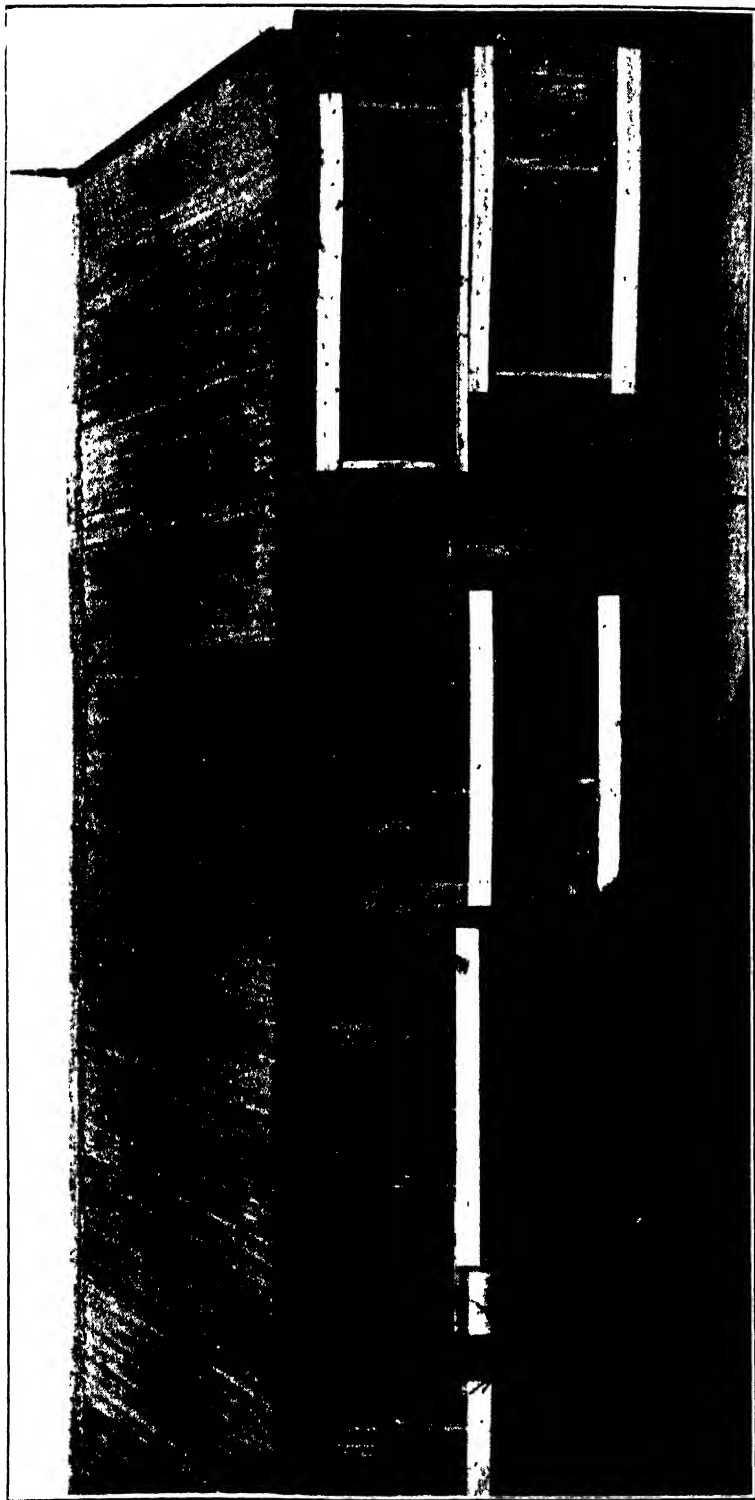
Mr. Tebbutt believes in keeping his chicks under cover during the period they require artificial heat—this usually meaning from 5 to 8 weeks according to the weather conditions prevailing at the time. To enable chickens to be reared successfully in confinement, large window-like openings, which extend to within a few inches of the floor of the south-eastern side of the barn, allow the chickens to receive the full benefit of direct sunlight.

In the type of brooder used, economy has been exercised without sacrificing efficiency. The brooders consist of simply constructed wooden boxes, on the lids of which are fastened sheets of asbestos and tin to reflect the heat downwards on the chickens' heads. Heat for the chickens is derived from a hurricane lamp possessing a large oil reservoir. Inside the box there is a small wooden platform which raises the chicks a few inches from the ground, thus bringing them nearer the source of heat. Ventilation is secured by holes bored at the top of the lid and in the sides of the box, and is controlled by the manipulation of small shutters. It must be admitted that



View of one of the breeding pens (Rhode Island Reds).

POLLTRY KEEPING IN A HUNTINGDONSHIRE ORCHARD



Fruit store successfully converted into a brooder house by introduction of openings into the south-east wall.

POULTRY KEEPING IN A HUNTINGDONSHIRE ORCHARD.

this brooder is not original, but there are advantages in its simplicity, the chief of these being that it can be readily made by the poultry keeper himself, thus reducing considerably the initial cost of equipment. Further, it serves to show that a successful plant can be built up by the extension and adaptation of material that may usually be found on every farm.

On reaching the stage when artificial heat ceases to be necessary the chicks are transferred to small movable houses of the lean-to type. These houses accommodate from thirty to forty growing stock. This number may be increased when the chicks are first put in them without fear of overcrowding, but as they grow the numbers are reduced by the removal of the cockerels as soon as they can be recognized. The house, which is sectional, can easily be moved to fresh ground in the orchard, thus extending the sphere of usefulness of the birds as regards the distribution of manure and the destruction of insect pests.

Subsequent Management.—Pullets are almost entirely relied upon for egg production, only a few selected second season hens being retained for breeding purposes. Breeding from pullets is practised, but it must be emphasized that great care is taken in selecting birds for the breeding pen, choice being made only from the well-developed and early hatched pullets.

The high cost of labour prevents the use of trap nests on the farm, and for this reason cockerels of good breeding are purchased each year from reliable breeders of trap-nested stock, and these are mated with selected hens and pullets on the farm.

As soon as the sexes can be distinguished cockerels are separated from the pullets and given a special fattening mash for a short period before sale to a Heathfield fattener, who makes a practice of purchasing direct, from farmers in this district, cockerels which are fit for fattening.

The pullets are run in the grass orchard until a later stage, when about 400–450 are selected for egg production and removed to their laying quarters in large houses on the cultivated part of the orchard. The surplus pullets are disposed of for a good price at a special auction sale held in the St. Ives Poultry Market each year. This sale is an annual event devoted chiefly to the disposal of specialist poultry farmers' surplus stock.

Fruit Production.—Mr. Tebbutt finds plums much more profitable than apples. Plums grow and crop well on this

deep, heavy loam, and the fruit of the Bluntisham district finds a ready sale in the northern markets, principally Manchester and Glasgow. The varieties grown are Rivers' Early Prolific, Czar, Victoria, Belle de Louvain and Monarch. The trees are sprayed in winter with a good tar-distillate wash, which destroys effectively all eggs of aphides and also those of winter moths laid on the trees before the buds commence to swell. It is considered that the poultry provide a substantial measure of control of the March moth, which may ascend the trees after tar-distillate spraying is finished, by catching the crawling wingless females as they emerge after pupation, as well as any caterpillars which are making their way from the trees to the ground during the summer. The insect pests of the apple are similarly dealt with, save that Mr. Tebbutt's experience regarding the apple blossom weevil confirm that of observers elsewhere, i.e., the poultry do not devour these beetles.

The land between the trees, which are planted 18 ft. \times 18 ft. apart, is ploughed in the winter with a special fruit tree plough which permits of all the ground being turned over. In the spring the land is harrowed down and re-harrowed once or twice later to provide a tilth. Beyond this, little cultivation is required as when the poultry are turned in they succeed in keeping the ground almost entirely free from weeds.

The writers were impressed with the healthy appearance of the trees on the holding, this testifying to the manurial value derived from the presence of the poultry. The grower assured them that no other form of manure was applied, yet the trees carried a wealth of healthy foliage and made a substantial amount of annual wood growth.

The only pruning received by the plum trees consists of the removal of dead wood, and this is performed in early summer to lessen the risk of silver-leaf attack. Silver-leaf is, in fact, a disease very little feared by Mr. Tebbutt as he is confident that the plum grower can, by his methods of cultivation, exercise a very substantial measure of control over it.

Mr. Tebbutt, with a very little outside assistance, himself carries out the work of the poultry farm and, by his mastery of the details and the art of chicken rearing, has made poultry a directly profitable business apart from the secondary advantages to which reference has already been made.

The final test of any particular system of management can be ascertained only by a detailed analysis of the financial

accounts. Although Mr. Tebbutt's accounts are not kept in such detail as to give definite costings, at the same time they supply sufficient evidence of the profitable nature of his poultry and fruit farm to convince anyone on this point.

* * * *

INSPECTION AND CERTIFICATION OF STRAWBERRY PLANTS AND BLACK CURRANT BUSHES

THE need for ensuring that pure stocks of the varieties of potatoes officially approved as immune from Wart Disease should be obtainable for planting in infected soil led the Ministry, in 1918, to organize a system of inspection and certification of growing crops of potatoes. The value of these certified stocks was soon recognized, and it was not long before the system was extended to all potato varieties. The institution of this scheme was the first link in the chain of action taken by the Ministry to provide growers with an opportunity to purchase, for propagation, material which could be relied on as being true to type and reasonably healthy. The next link was the issue in 1921 of Orders under the Destructive Insects and Pests Acts, which required official health certificates to accompany imported nursery stock and prohibited the sale in this country of plants substantially attacked by certain diseases and insect pests. The following note gives details of two further extensions of the "clean seed" policy which show an advance on the potato inspection system in that they pay regard to the health and vigour of the stocks certified as well as to their purity.

Strawberry Plants.—During the War years the strawberry crop was not of first-rank importance, and it had perforce to give way to crops of more vital interest from the point of view of national food production. With the return of normal conditions and the entry on the land of large numbers of small holders, a great stimulus was given to strawberry cultivation and the acreage under the crop rapidly increased. Complaints of unsatisfactory crops soon became fairly general, and inquiries into the matter made it abundantly clear that the trouble was in great part due to the fact that the enhanced demand for runners had resulted in the impoverishment of the varieties by the planting of inferior stocks. The fact that a satisfactory yield cannot be expected from inferior stock, whatever may be the standard of cultivation, is now generally

appreciated, and growers are beginning to realize that it is false economy to plant low-grade material. The Ministry's certificate system affords an opportunity of purchasing stocks that at the time of inspection were true to type, vigorous growers and, so far as could be seen, free from disease. It is not surprising, therefore, that great value is attached to the certificates alike by the grower and the seller of strawberry runners.

The certificates issued for strawberry plants are of two kinds, viz., (a) ordinary certificates, and (b) "super" certificates. Certificates of the first type are issued in respect of stocks which are typical of the variety and contain not more than 1 per cent. of rogues. A high standard of health and vigour at the time of inspection is a further requirement, though it is not possible in the form of certificate to attest the qualities of the stocks in these respects.

"Super" certificates were introduced in 1928 to create a distinction necessary to meet the special case of the grower who, in order to improve the quality of the stock, practises rigorous restriction of his runners. Applicants for this special certificate are required to give a written undertaking to limit to not more than five the number of runners on each parent plant. The usual high standard of purity, health and vigour is, of course, essential to qualification for this type of certificate no less than for the ordinary form.

One of the difficulties experienced by Inspectors engaged on strawberry inspection work in the 1928 season was the very wide range of varieties of plants which they were called on to examine. They had to certify no fewer than 74 distinct varieties, only a small proportion of which were of any importance commercially. In 1929 it was decided that applications should be accepted for the inspection of stocks of the following eleven varieties only: Bedford Champion, Jucunda (Amazone), Leader (Kentish Favourite), Madame Kooi (Princess Juliana), Madame Lefebvre, Oberschlesien, Royal Sovereign (Laxton's King George V), Sir Joseph Paxton, Stirling Castle (Garibaldi), The Duke and The Laxton.

Table I opposite compares the number and acreage of stocks involved in the applications received in the seasons 1927-29.

This table indicates that nearly one-half of the total acreage dealt with this year was of the variety Royal Sovereign, which showed an increase of 20 per cent. over 1928, whilst a further quarter was of the variety Sir Joseph Paxton. At the other

TABLE I.

Variety	1927		1928		1929	
	No. of Stocks	Acreage	No. of Stocks	Acreage	No. of Stocks	Acreage
Bedford Champion	3	1.8	15	7.1	18	11.6
Jucunda	1	.1	4	.7	8	2.2
Leader	3	1.1	10	3.4	15	4.9
Madame Kooi ..	1	.4	5	2.8	12	6.3
Madame Lefebvre	4	2.4	16	10.3	15	9.8
Oberschlesien ..	1	.1	3	.7	8	4.3
Royal Sovereign ..	30	43.5	50	76.6	57	92.9
Sir Joseph Paxton	16	25.5	38	48.6	36	48.8
Stirling Castle ..	1	.1	6	11.1	5	.7
The Duke	5	3.5	12	9.6	12	7.2
The Laxton	6	3.3	6	4.8	13	8.9
Others	21	8.1	93	24.3	—	—
Totals	92	89.9	258	200	199	197.6

end of the scale came Jucunda with 2.25 acres and Stirling Castle with less than an acre. In spite of the limitation of the number of varieties covered by the scheme, the total acreage dealt with in 1929 was almost equal to that of the previous season, which included 24 acres of plants of little-known varieties.

The majority of the applications were received from growers in the Wisbech area of the Isle of Ely, Lincolnshire (Holland) and Norfolk. Of the total of 81 applications, 44 came from this area, 9 from Kent and the remainder from various parts of the southern counties.

Of the total area of 197.6 acres dealt with, ordinary certificates were issued in respect of 162.3 acres (including 1.25 acres where "super" certificates were applied for but the applicants found it impossible to carry out the prescribed runner restrictions) and "super" certificates in respect of 8.8 acres. One application for a "super" certificate in respect of 5 acres was withdrawn, and the remaining 21.5 acres were rejected as not typical of the variety or as lacking in vigour. Details of the stocks certified under each variety are given in Table II overleaf.

The area certified represents about 89 per cent. of the total area dealt with, a figure which compares very favourably with 78 per cent. in 1928 and 72 per cent. in 1927.

A gratifying feature of the inspections was the high standard of purity of the stocks examined, the presence of rogues

TABLE II.

Variety	Ordinary Certificates		"Super" Certificates	
	No. of Stocks	Acreage	No. of Stocks	Acreage
Bedford Champion ..	17	11.4	—	—
Jucunda	6	1.9	—	—
Leader.. ..	12	4.5	—	—
Madame Kooi ..	6	4.0	1	.005
Madame Lefebvre ..	12	8.4	—	—
Oberschlesien ..	6	4.2	1	.02
Royal Sovereign ..	34	69.7	7	7.8
Sir Joseph Paxton ..	28	45.0	2	1.02
Stirling Castle ..	5	.7	—	—
The Duke	10	6.3	—	—
The Laxton	9	6.2	—	—
Totals ..	145	162.3	11	8.845

exceeding the limit of 1 per cent. being the reason for the rejection of only 5 acres of plants. The presence of weak plants or the general weakness of stocks owing to late planting was responsible for the rejection of 16 acres.

Reports by Inspectors engaged on the work indicate that they have noticed a marked improvement in the condition of commercial strawberry plantations, particularly in the Wisbech area, and they have no hesitation in attributing this improvement to the strawberry inspection scheme coupled with the general advisory work undertaken in recent years. Inspectors were also impressed by the excellent condition of a number of stocks grown from restricted runners. The advantages to be gained by runner restriction are very obvious where stocks from restricted and unrestricted runners are grown alongside. It is therefore a little disappointing that in 1929 fewer than 9 acres of plants qualified for "super" certificates. The opinion has been expressed, however, that restriction—if not to the extent necessary to qualify for "super" certification—will be more and more widely practised in the future.

Black Currant Bushes.—The black currant growing industry also has had serious problems to face during recent years, chief among which is "Reversion," which has become one of the most formidable obstacles to successful cropping. Here again attention to stocks bought for planting is of the utmost importance; they should be free from infection if any measure of success is to be achieved in keeping the trouble within bounds.

Certificates for black currant bushes are issued for stocks believed to be true to type and apparently free from reversion at the time of inspection. The procedure with regard to nomenclature is to certify bushes as true to one of the four main group types (*viz.*, (1) French Black, (2) Boskoop Giant, (3) Edina and (4) Baldwin) and to insert in brackets any varietal names given by the applicant. A few varieties have not been classified in any of the group types, and in these cases stocks are certified as true to the variety.

As in the case of strawberry plants, it is not possible to declare in the certificate the general condition of a stock as regards vigour and health—other than the essential point as to reversion—but Inspectors have definite instructions not to issue certificates for stocks which are unsatisfactory in these respects.

The scheme as operated in 1929 was confined to stocks of bushes two years of age and over—*i.e.*, bushes grown from cuttings taken not later than the autumn of 1927. In the previous season Inspectors had experienced some difficulty in dealing with maiden bushes owing to the danger of judging the presence of reversion and the uncertainty in identifying the parents (even if the latter were on the same farm, which in many cases they were not). Apart also from any question of the presence of reversion, many stocks had to be rejected owing to lack of vigour, and the position with regard to maidens was considered to be so unsatisfactory that it was decided to exclude them from the scheme in 1929.

Applications were received from 23 growers for the inspection of 545,660 bushes. The average number of bushes per application was about 24,000, the largest case involving just over 100,000 bushes. In the previous season 32 applications were received for the inspection of about 1,000,000 bushes (about half a million of which, however, were maidens).

In Table III overleaf are given for each of the main group types of bushes and for unclassified varieties the numbers of bushes inspected in 1928 and 1929 and the numbers certified as true to type and apparently free from reversion at the time of inspection: maiden bushes have been excluded from the figures for 1928.

The Boskoop Giant and Edina groups showed an increase in the number of bushes inspected, but they were again much less prominent than the other groups. The Baldwin group, to which belonged nearly 40 per cent. of the total bushes dealt with in 1928, claimed only about 30 per cent. last season and was just exceeded by French Black.

TABLE III.

Group	1928			1929		
	Inspected	Certified		Inspected	Certified	
	No.	No.	Per-centage	No.	No.	Per-centage
French Black	123,830	98,590	80	159,500	140,000	88
Boskoop Giant	26,700	18,870	71	58,600	55,460	95
Edina ..	37,210	34,460	93	54,240	51,240	94
Baldwin ..	204,110	184,180	90	158,520	133,470	84
Unclassified ..	130,150	103,900	80	114,800	102,400	89
Totals ..	522,000	440,000	84	545,660	482,560	88

The percentage of rejections in 1929 was 12, a figure which compares favourably with that of the previous year when, of the bushes two years of age and over, about 16 per cent. failed to qualify for certification.

Of the stocks which Inspectors were unable to certify, 26,000 bushes were rejected owing to lack of vigour, 12,100 owing to the presence of reversion, 18,000 owing to the presence both of rogues and reverted bushes, and 7,000 owing to weakness and reversion. The inference is that, on the whole, the stocks submitted for examination were of a high standard of purity.

The bulk of the stocks certified were two-year-old bushes (300,000 out of 483,000). Of the remainder, 111,000 were three year bushes, 52,000 four year and 20,000 five year.

* * * *

INSTRUCTION IN CLEAN MILK PRODUCTION

Two points of outstanding interest in connexion with instruction in clean milk production during the past year deserve special notice. These are :—

- (1) The increased interest in the movement displayed by the trade ; and
- (2) The introduction of non-competitive advisory schemes, in place of clean milk competitions, for producers who have already achieved a certain standard of proficiency.

The attitude of the trade was fully dealt with in an article entitled " The Purchase of Milk on a Quality Basis ", published in this JOURNAL in September, 1929, in which particulars were given of eleven bonus schemes organized in conjunction with county clean milk competitions which provided for payments

on a gallonage basis, or, alternatively, cash prizes of definite amount. There is every indication that the number of such schemes will be increased during 1930.

Advisory schemes were conducted in five counties and, as there was some variation in the conditions and procedure, brief particulars of the schemes are set out below :—

- (1) *Wiltshire*.—In this county the scheme was divided into two sections for (1) producers who had obtained a certificate of merit in a clean milk competition organized by the Wiltshire Agricultural Education Sub-Committee, and (2) licensed producers of "Designated" milk.

For the first class a "County Register of Accredited Producers" was instituted for an experimental period of twelve months, during which eight milk samples were submitted by the producer and at least two "surprise" samples were taken by an officer of the Committee. The standard for Grade "A" Milk was adopted in connexion with the Register, and it was provided that a producer who consistently failed to attain this standard would be liable to suspension. The only awards in connexion with the scheme were for employees.

The section for producers of "Designated" Milk provided for a similar number of samples to be tested, and was instituted for the sole purpose of assisting such producers to maintain the required standard.

In all, 36 producers participated in this scheme.

- (2) *Essex*.—The scheme in this county provided for the testing of fortnightly milk samples from producers who had obtained diplomas in previous competitions, and was conducted during the months of May, June, July and September; 19 producers took part in the scheme.
- (3) *Nottinghamshire*.—An advisory scheme of 12 months' duration was introduced in two districts. Monthly milk samples were submitted for examination, and periodical visits were paid by an officer of the Committee for the purpose of inspecting methods, etc., or taking "surprise" samples. More than 50 producers were concerned in this scheme.
- (4 & 5) *Staffordshire and Lindsey*.—The schemes in these counties are carried out with the co-operation of the Medical Officers of Health and the Sanitary Inspectors, who are asked to notify the Education Authority of any cases in which unsatisfactory milk is being produced. An officer of the Committee visits the producer concerned to give advice and assistance in improving the milk supply.

The introduction of these advisory schemes has inevitably led to some reduction both in the number of clean milk competitions held and of producers competing, as may be seen from the comparative statement for the years 1927-28 and 1928-29 which is printed below. A further factor which has tended to reduce the number of competitors is that many authorities concentrated on new competitors and made no provision for producers of "designated" milk or for prize winners in previous competitions. It will be seen that, of a total entry of 953, the number of new competitors amounted

CLEAN MILK COMPETITIONS, 1927-1929

COUNTY	COMMENCED 1927-1928					COMMENCED 1928-1929					Individual producers who have competed at least once	
	Com-peti-tors	Cows	Samples ex-aminated	Samples "Graded" standard	Total advisory visits	Com-peti-tors	New com-peti-tors	Cows	Samples ex-aminated	Samples reaching "Graded" standard		Total advisory visits
ENGLAND—												
Berks ..	24	824	288	271	30	31	9	1,251	478	445	44	56
Bucks ..	31	692	204	153	193	76	36	1,566	365	258	155	101
Cambridge ..	21	596	134	91	64	11	3	312	83	52	40	24
Cheshire ..	26	1,227	222	178	56	18	6	574	162	144	60	73
Cornwall ..	23	453	207	202	115	—	—	—	—	—	—	58
Cumberland and Westmorland ..	19	660	142	68	76	20	14	542	159	76	84	55
Derby* ..	—	No record	—	—	—	44	20	876	258	127	270	44
Devon ..	—	—	—	—	—	—	—	—	—	—	—	62
Dorset ..	7	206	42	22	12	—	—	—	—	—	—	53
Durham ..	15	305	116	78	65	25	16	527	200	90	120	38
Essex ..	44	1,989	396	373	120	16	16	431	128	87	61	124
Gloucester ..	31	883	186	156	118	32	17	900	190	154	120	59
Hants ..	116	4,215	682	273	460	46	21	1,594	†184	†67	†169	141
Hertford ..	35	1,285	315	266	85	73	42	2,258	650	394	156	94
Hunts ..	—	—	—	—	—	13	13	307	78	66	82	13
Isle of Ely ..	—	—	—	—	—	10	10	200	60	36	50	10
Kent ..	33	716	396	283	116	29	8	663	349	247	110	121
Leicester ..	56	642	342	88	89	—	—	—	—	—	—	79
Lincs, Kesteven ..	18	226	110	61	142	—	—	—	—	—	—	82
.. Lindsey ..	15	221	118	96	90	†	17	199	102	73	136	37
Middlesex ..	11	522	99	77	60	—	—	—	—	—	—	30
Norfolk ..	—	—	—	—	—	14	5	568	126	88	65	27
Northants ..	26	550	136	116	138	27	27	780	188	97	81	51
Northumberland ..	26	625	182	139	78	25	12	542	149	69	130	61
Notts ..	34	454	299	199	85	—	—	—	—	—	—	83
Oxford ..	14	473	120	108	73	—	—	—	—	—	—	58
Rutland ..	—	—	—	—	—	31	22	1,045	295	178	184	13

	17	468	85	65	17	10	2	334	50	45	10	31
Salop ..	73	2,832	438	237	219	—	—	—	—	—	—	218
Somerset ..	—	—	—	—	—	—	—	—	—	—	—	20
Staffs ..	31	775	279	249	124	33	8	886	297	261	132	61
Suffolk, E. & W.	45	1,250	407	291	170	40	10	1,369	340	261	160	119
Surrey ..	63	1,800	252	89	252	62	23	1,800	†124	†97	†124	163
Sussex, E.	22	612	187	92	80	24	15	668	203	111	68	129
Sussex, W.	29	719	261	129	145	33	14	1,061	297	223	165	59
Warwick ..	41	2,009	367	263	160	29	11	1,390	252	166	90	164
Wilts ..	12	290	108	96	60	21	19	312	189	136	63	53
Worcester ..	39	784	472	420	58	39	32	782	468	356	72	108
Yorkshire ..	—	—	—	—	—	—	—	—	—	—	—	—
<i>Total, England..</i>	997	29,303	7,592	5,229	3,550	849	448	23,737	6,424	4,404	3,001	2,772
WALES—												
Anglesey ..	10	148	90	68	48	15	11	183	79	52	98	26
Brecon & Radnor	8	144	64	53	40	14	14	unknown	39	22	32	35
Cardigan ..	26	310	156	94	30	—	—	—	—	—	—	26
Carmarthen ..	11	263	99	66	15	—	—	—	—	—	—	33
Caeuarnvon ..	—	—	—	—	—	19	19	340	115	80	78	19
Denbigh ..	65	1,085	772	351	98	—	—	—	—	—	—	80
Flint ..	16	318	128	86	40	14	10	263	126	86	38	44
Merioneth ..	—	—	—	—	—	15	15	135	45	27	36	15
Montgomery ..	—	—	—	—	—	—	—	—	—	—	—	18
Pembroke ..	23	276	111	73	145	27	13	357	159	139	74	48
<i>Total, Wales ..</i>	159	2,544	1,420	791	416	104	82	1,278	563	406	356	344
<i>Total, England and Wales ..</i>	1,156	31,847	9,012	6,020	3,966	953	530	25,015	6,987	4,810	3,357	3,116

* Modified competitions are held in Derbyshire and particulars relating to previous years are not available.

† These figures are incomplete as the competitions were still in progress at the time the return was made.

‡ A modified local competition was held in this county.

In addition to the competitions for milk-sellers, competitions were held for butter-makers in Pembroke (1927-28 and 1928-29) and in Anglesey and Brecon and Radnor (1928-29). Particulars relating to these competitions are included above. The Brecon and Radnor Butter Competition was not completed at the time the return was made.

to 530. Milkers' competitions to the number of 66 were held during the year, and 898 of the 1,084 competitors reached proficiency standard.

* * * *

BIRMINGHAM AND MIDLANDS ALLOT- MENTS ASSOCIATIONS' LAND PURCHASE SCHEMES

W. H. JENKIN,

Ministry of Agriculture and Fisheries.

Victoria Jubilee Allotments Association, Ltd., Handsworth, Birmingham.—This Association completed the purchase of their allotments, amounting to 18 acres, in 1928, and are now in a healthy and prosperous condition. The social side has been well catered for, in the erection of club rooms and concert rooms, tennis and cricket areas, etc., and the whole of the participants are content in this security.

Witton and District Allotments Association, Ltd.—This Association arose out of the need to provide more food during the war. The land was first acquired by the Birmingham Corporation under emergency powers, and the area of 82½ acres was turned into allotments in 1917. The allottees formed themselves into the Witton and District Allotments Association, and ultimately into a limited company, which was duly registered under the Friendly Societies Acts, since which time it has been managed by a popularly elected secretary and committee. With a membership amounting to approximately 800 plotholders, the need was felt for some effort to bring about social unity amongst them, and ultimately a large barn on the allotments was acquired, and fitted up as a club room for these purposes. The necessary application was made to the Registrar of Friendly Societies for registration.

About this time the existence of the Association was threatened because it was thought the land would be given up. In the beginning of 1922, therefore, the Corporation of Birmingham were asked to acquire the land permanently for allotments. Owing to the great financial stringency at the time the Birmingham Corporation were unable to accede to this suggestion, and there was grave danger of the plotholders being dispossessed. In this dilemma the legal advisers to the Association were consulted, and after some negotiations a contract to purchase the whole estate was entered into by Mr. Foster Duggan at the price of £7,000. Steps were then taken for the issue of share capital to members, an overdraft was obtained from the Midland Bank, Ltd., and the purchase

was completed. To obtain this overdraft at the bank a personal guarantee had to be given. Each succeeding year has seen the success of the social club and the plotholders generally, with the result that year by year the borrowed moneys have been repaid, until to-day the whole of the estate with its valuable road frontages is entirely free from debt.

Stockingford Allotments Association, Ltd.—Situated in the coal mining area of Warwickshire, this Association presents a fine record of courage, loyalty and business ability. In 1920 the Association had under cultivation 25 acres of allotments with 346 plotholders. In March of that year the farm upon which these allotments stood was advertised for sale, and the allottees were threatened with dispossession. The Agricultural Organization Society were consulted and their representative discussed the matter with the Allotments Committee. This resulted in a deputation to the landowner's solicitor. The deputation learned from the interview that it was only possible to buy the allotment land by purchasing the whole farm of 90½ acres. The matter was submitted to a general meeting of the allottees. This meeting decided to acquire the whole of the land if the price could be brought within reasonable limits. After negotiations the Association procured the land for £5,800. A deposit of 10 per cent. of the purchase price was paid in March, 1920, and after negotiating an overdraft with the Bank, the remainder of the purchase price was paid in July of that year.

The coal stoppage of 1921 placed the Association in a very trying and difficult position. Up to the time of the stoppage the members had contributed share capital on a most generous scale, some taking up the maximum holding of £200, others £100, and quite a number of £50 shares, members in varying degree investing the whole of their savings in the Association. During the stoppage, and for some considerable time afterwards, the income from share capital was negligible, and the overdraft at the bank stood as high as £3,314. This was a time of great anxiety to the Management Committee, and had it not been for their courage and persistency, disaster would have overtaken them.

The estate had approximately half a mile of frontage on a main road, and the committee, after consulting the Agricultural Organization Society, advised the sale of a portion of this road frontage for building purposes. Steps were immediately taken to advertise, and in 1922, frontage to the value of £819 was sold; in 1923, a further £2,687 worth of frontage was

sold, leaving about £1,000 worth of frontage. By this means the Association was able to reduce the Bank overdraft to quite a small amount in 1923; indeed, it would have been wiped out altogether had it not been for further liabilities incurred during the year by the erection of a fine institute and club for the use of the members. The Bank debt was, however, cleared in June, 1924, and the title deeds came into the possession of the Association. Since that time the membership of the Association has increased, and the share capital is now roughly £2,800.

Since 1924, the Association has purchased two houses near their institute and club house, one for the extension of this building and the other as a residence for the steward.

Six lawn tennis courts, a bowling green, cricket and football grounds have developed for the social side, and the committee are, at the present time, erecting a pavilion in connexion therewith.

During the last coal stoppage, £700 was given in food tickets, and shareholders have had 5 per cent. interest since the commencement of the scheme, with an extra 5 per cent. bonus in 1928-29.

NOTE.—There are several courses open to Allotment Societies wishing to purchase their land and the Ministry will be glad to furnish particulars on application.

* * * *

MARKETING NOTES

MARKETING UNDER THE NATIONAL MARK

National Mark Egg Scheme.—The flush season has now opened; in fact, increased supplies began to come forward earlier than usual this year. With supplies plentiful, the statutory guarantee attaching to National Mark eggs is all the more valuable as a selling factor, and it is anticipated that authorized packers will have no difficulty in disposing of their supplies. In order to broaden the channels of distribution of National Mark eggs in the wholesale trade during the glut period, a voluntary scheme of group selling agencies has been devised to operate experimentally during the current year. The scheme has been submitted to authorized packers for consideration, and, should sufficient support be forthcoming, it will be put into effect forthwith.

National Mark Malt Products Scheme.—The following firms

have been added to the list of authorized makers and packers in the scheme :—

John Hare, Henlow, Biggleswade.

Boots Pure Drug Co., Ltd., Nottingham.

C. Tolkien & Co., Ltd., Silsden.

Johnson & Sons, Hendon Way, London, N. 4.

The full operation of the scheme was deferred pending the outcome of discussions with representatives of wholesale and retail traders in malt extract regarding arrangements for the regulation and development of the distribution of the National Mark malt products. These have now resulted in a basis of procedure which the Minister, on the recommendation of the National Mark Malt Products Trade Committee, has approved. The arrangements include the formation of a "National Mark Malt Products Association," which all authorized makers and packers are required to join before commencing operations under the scheme.

National Mark Beef Scheme.—The number of sides of beef marked with the National Mark each week since the week ended December 7, 1929, has been as follows :—

<i>Week ended</i>			<i>Select</i>	<i>Prime</i>	<i>Good</i>	<i>Total sides marked (Quarters and pieces omitted)</i>
1929			LONDON			
December	14	..	564	383	82	1,029
"	21	..	1,403	441	44	1,888
"	28	..	253	67	2	322
1930						
January	4	..	341	347	19	707
"	11	..	592	412	41	1,045
1929			BIRKENHEAD*			
December	14	..	2	128	53	183
"	21	..	99	289	30	418
"	28	..	—	51	36	87
1930						
January	4	..	—	123	66	189
"	11	..	—	140	45	185
1929			SCOTLAND*			
December	14	..	1,671	202	—	1,873
"	21	..	1,787	171	—	1,958
"	28	..	1,066	120	—	1,186
1930						
January	4	..	896	88	—	984
"	11	..	1,432	212	—	1,644
1929			BIRMINGHAM			
December	14	..	175	187	48	410
"	21	..	317	255	50	622
"	28	..	36	110	37	183
1930						
January	4	..	129	204	26	359
"	11	..	147	229	28	404

* Sides consigned to Smithfield Market, London.

The number of names on the roll of London meat traders regularly selling National Mark beef on January 8 was 302, representing 733 shops, and on the Birmingham roll 252 traders, representing 439 shops. In the special campaign in London and Birmingham, referred to in the issue of the JOURNAL for January, very wide publicity, which had a most stimulating effect on the sales of National Mark beef, was given to the addresses to representatives of the Press on December 11 by the Parliamentary Secretary to the Ministry and the Under-Secretary for Scotland, and to a further speech made by Dr. Addison at Shrewsbury on December 14, to the Welsh Council of Agriculture. The Empire Marketing Board hoardings—326 in London and 51 in Birmingham—were posted with National Mark Beef posters from December 11 to 24. In the South London area, which was selected for special publicity, Press advertisements appeared in 29 selected suburban papers. In addition to attractive window cards which were issued to all butchers on the London and Birmingham rolls, leaflets calling attention to the scheme were distributed in Birmingham through the medium of the schools, and to private houses in the South London area.

The Ministry placed four of its Inspectors in the South London area during the period of the campaign for a canvass of butchers, and 401 shops were visited. Three Inspectors were placed in the Birmingham area for a butcher-to-butcher canvass, and 116 shops and a number of hotels and restaurants were visited. The result of the campaign was that 56 butchers' shops in the selected South London area, 287 shops in the rest of London, and 89 shops in Birmingham and district, were added to the Roll.

The large increase in the sales of sides of National Mark beef as the result of the campaign is clearly indicated in the figures set out above.

A noteworthy feature of the London campaign was the support received from the Royal Arsenal Co-operative Society, with 70 retail shops, and the South Suburban Co-operative Society, with 20 shops.

The Ministry is now considering, in conjunction with the Empire Marketing Board, the continuance of publicity by direct approach to individual householders in selected districts of London and Birmingham.

During the Christmas season, the number of Birkenhead-killed sides of high quality at Smithfield, and the improvement

in the general level of conformation, were particularly noticeable. Consequently, a large number of these sides were put into the "Select" grade. It is clear that this feature is largely due to the elimination of inferior bulls in Ireland. A number of English sides fully came up to the same standard, and supplies of this high quality were principally North Devons.

It should be understood that in judging grade the Ministry's scheme definitely takes conformation into consideration. The most difficult task of the grader is when sides are of good quality and finish but their conformation is inferior, so that they cannot be placed in the "Select" class on that account, though they would qualify for it in other respects. There is room for much improvement in this respect in English cattle. It is disappointing to have to grade as "Prime" an animal which would be "Select" but for the length of its leg and a relative deficiency of flesh in the back. The use of better bulls and more care in rearing would undoubtedly do much to remove this handicap. As the Norfolk season is now getting under way, this point is being carefully watched by the Ministry's Marketing Officers. Norfolk cattle are second to none in quality and finish, but there is a percentage which, on account of conformation, and, therefore, through no fault of the feeders themselves, does not reach a standard sufficiently high to enter the "Select" grade.

National Mark Wheat Flour Scheme.—The following additional firms have been authorized to pack All-English Wheat Flour under the National Mark:—

<i>Beds.</i>	W. Jordan & Son, Sandy.
<i>Berks.</i>	S. M. Soundy & Son, Abbey Mills, Reading.
<i>Cambs.</i>	A. Pearce & Son, The Kings Mill, Great Shelford.
<i>Essex.</i>	E. Chopping & Son, Ltd., Roman River Roller Mills, Colchester.
	T. & H. King, The Mills, Great Chesterford.
<i>Glos.</i>	James Collins, Sons & Brain, Ltd., Warmley Flour Mills, near Bristol.
<i>Hants.</i>	Botley Flour Milling Co., Botley.
<i>Herts.</i>	Thos. Burton, Ltd., Sawbridgeworth.
<i>Hunts.</i>	C. J. Sampson & Son, Water Newton Mill, near Peterborough.
<i>Lancs.</i>	T. Seymour Mead & Co., St. George's Hall, Upper Medlock Street, Manchester.
<i>Lincs.</i>	Blaze, Allott & Co., Ltd., 64 Monson Street, Lincoln.
	Molesworth & Springthorpe, South Luffenham.
<i>Northants.</i>	Whitworth Bros., Victoria Mills, Wellingborough.
<i>Staffs.</i>	J. N. Miller, Ltd., Old Steam Mill, Wolverhampton.

- Suffolk.** D. Alderton, Topposfield Mills, Hadleigh.
C. A. Barron, Swilland, Ipswich.
G. & J. Cutting, Roller Mills, Pettaugh, Stowmarket.
A. Hayward & Sons, Roller Mills, Woodbridge.
R. Rackham, Deben Roller Mills, Wickham Market.
- Sussex.** J. Gwillim, Coultershaw Mill, Petworth.
- Warwick.** C. Lucy & Nephew, Ltd., Flour Mills, Stratford-on-Avon.
E. M. Bates, 106-108 Park Road, Rugby.
- Wills.** F. Skurrey & Son, Town Flour Mills, Swindon.

The total number of authorized millers and packers is now 160, and a complete list of the names and addresses may be obtained on application to the Ministry. A list containing the names of over 100 bakers who are prepared to supply bread baked wholly from National Mark flour has also been prepared by the Ministry, and copies may be had on request.

National Mark Fruit Scheme (Apples and Pears).—National Mark apples have been in short supply during the last month, all dessert varieties other than Cox's Orange being sold out. Large supplies of Bramley's which have been held in cold-store are now coming on the markets. There has recently been a glut of inferior home-grown apples, and the cash returns for these should convince growers of the imperative need for raising the standard of production. The demand for high-grade fruit is in excess of the supply and should stimulate producers to pay increasing attention to quality.

Displays of Home Produce.—A display of National Mark commodities was staged at the Brighton and Hove Home-life Exhibition, held in Brighton from January 22 to February 1. The particular commodities selected for display were Apples, Wheat-flour, Malt-flour, Malt Extract and Eggs, and working demonstrations of grading and packing eggs were given by a local registered packer.

Further publicity is also being afforded to National Mark products in Birmingham, by means of a show-case hired from the management of the Birmingham Hippodrome, for a period of three months. The initial display consisted of National Mark beef (*see* illustration facing), in order to coincide with the general publicity scheme then being conducted in that town; this was followed by a display of flour and eggs, which synchronized with the second half of the Birmingham Grocers' Exhibition.

Grading of Ware Potatoes.—What constitutes a marketable sample of ware potatoes? In other words, what is the maximum amount of diseased or damaged tubers and of earth

MINISTRY of AGRICULTURE

NATIONAL MARK PRODUCE



Showcase display of National Mark Beef at the Birmingham Hippodrome.

or other extraneous matter that may be admitted in commercial consignments? Hitherto, there has been no standard specification to which the potato trade could work in this matter. This lack of a standard dressing has involved unnecessary risks in trading and has handicapped growers and distributors alike. To remedy this state of affairs and put the commercial handling of the crop on a better basis, the Minister of Agriculture and Fisheries has accordingly made regulations* under the Agricultural Produce (Grading and Marking) Act, 1928, prescribing and defining grade designations for voluntary use by the trade. The definitions provide for a common standard of dressing, and vary only as regards the minimum diameter of the potatoes as indicated by the mesh of the riddle over which they are passed. These designations and definitions are set out on p. 1091.† They furnish the trade with a standard system of grading, according to both size and dressing, which should do much to simplify marketing and check wasteful and unfair practices.

It should be explained that, under the Agricultural Produce (Grading and Marking) Act, 1928, it is provided that where any person sells any article of agricultural produce to which a statutory grade designation is applied, then, notwithstanding any contract or notice to the contrary, it shall be deemed to be a term of the contract of sale that the quality of the article accords with the statutory definition of the grade designation.

The Act also enables the Minister to prescribe grade designation marks, and it is in the exercise of these powers that National Mark schemes have been brought into operation for various other products. Owing to differences in public taste and to the difficulty of defining cooking quality, no provision is being made, at the moment, for the use of the National Mark on consignments of graded potatoes. It is believed, however, that even without the use of the National Mark, the existence of statutory standards of dressing and sizing will be as beneficial to the potato industry of this country as it has proved to be elsewhere, and that, in time,

* Agricultural Produce (Grading) (Potatoes) Regulations, 1929: Obtainable from H.M. Stationery Office, price 1d. net.

† When selling or offering graded potatoes for sale, the description of variety, district where grown and soil origin of the potatoes may, of course, still be used, in addition to the grade designation, as an indication of cooking characteristics. For example, potatoes at present described in the trade as "Blackland Majestic" may, in future, be described as "E. & W. No. 1 Size Blackland Majestic," "E. & W. No. 2 Size Blackland Majestic" or "E. & W. No. 3 Size Blackland Majestic," etc., if sold in accordance with the grades.

these standards will work their way voluntarily into the trade on their merits. The grade specifications will, for instance, be found particularly useful to institutions and other large buyers who have to place contracts for the delivery of potatoes over a period.

It is desirable to emphasize the fact that the object of introducing voluntary grades in this way is, first, to make possible a clear distinction on the market between well-dressed potatoes and those which are badly dressed, so that growers and merchants who exercise care in packing may be duly rewarded; secondly, by introducing a statutory definition for marketable ware potatoes, to assist distributors of all kinds in their business; and, thirdly, to give confidence to consumers, especially in the large populous centres, and so improve the demand for home-grown potatoes to the advantage of the industry as a whole. It should be borne in mind, in this connexion, that not only have growers to compete with one another on the market, and not only has the home crop to meet, at times, the competition of imports, but potatoes have to compete with other foodstuffs for a place on the consumer's table. It is important, therefore, that potatoes should be made as attractive to buyers as possible, and it is thus in the interests of the industry as a whole that a high standard of dressing according to grade should be generally adopted.

Further, it is difficult to see how the problem of improving the methods of distribution and of dealing with small, surplus or inferior potatoes can be approached with any prospect of success until the national grades are widely used in marketing the crop.

Unit of Weight for Fat Pig Prices.—Prices of fat pigs are, at the present time, variously quoted in different parts of the country by the score or by the stone of 14lb., 12lb. or 8lb.; consequently, it is not easy for producers to compare prices.

The Pig Industry Council has therefore recommended that the common unit of weight for both live and dead-weight transactions should be the score (20lb.), and that it should be clearly stated in all transactions whether the unit refers to live or dead-weight. In arriving at this decision, the Council took into consideration the fact that the score is the unit in most common use throughout the country.

It is hoped that the Council's recommendation for a common unit for the whole country will be encouraged by the trade.

In accordance with the Council's recommendation, the Ministry has decided to adopt the score unit for the fat pig

STATUTORY GRADE DESIGNATIONS AND DEFINITIONS OF QUALITY FOR POTATOES PRODUCED IN ENGLAND AND WALES
Definitions of Quality.

Grade Designation.	General.	Applicable to Quantities.				
		Applicable to Single Tubs.		Tolerances.		
		Size (Minimum diameter).	Conformity to Variety, etc.	Undersize or Oversize.	Disease,* damage, etc.	Earth and/or extraneous matter.
(1) E. & W. No. 1 Size	(2) Reasonably clean, healthy potatoes, free from serious defects and suitable for human consumption.	(3) 1½ in.†	(4) At least 95 per cent., by count, must conform to the variety as specified and to the type of soil on which grown, where such is declared.	(5) Not more than 3 per cent. of the total weight may pass through a riddle or sieve having a square mesh of the minimum size† specified (in col. 3) for the grade, and, included in this, not more than 0.5 per cent. of the total weight may pass through a 1-in. mesh: potatoes which exceed ¾ in. in their smallest diameter shall be excluded. Otherwise, in regard to size, the potatoes shall be as grown.	(6) Not more than 3 per cent. of the total weight may consist of appreciably diseased, damaged or unsightly potatoes, and, included in this amount, not more than 0.25 per cent. of the total weight may be obviously affected with soft rot.	(7) Not more than 4 per cent. may be present in potatoes loaded up to November 1 in the year of harvesting, and 2 per cent. after that date; the percentage to be calculated on the net weight of screened potatoes.
(2) E. & W. No. 2 Size		1½ in.				
(3) E. & W. No. 3 Size		1½ in.				

* (i) Any disease or defect, the presence of which may be established by cutting open the potato, shall be taken into account, and potatoes having worm or slug holes penetrating into the flesh shall be regarded as damaged.

(ii) Potatoes affected by superficial disease or damage shall not be regarded as diseased or damaged unless more than one-tenth of the surface is so affected.

(iii) A potato shall only be regarded as being obviously affected with the soft rot if, at the time of inspection, it is squashey and/or the surface is at some part distinctly broken or wet owing to disease.

† When the potatoes have been passed over a riddle of greater mesh than 1½ in., the minimum size may, at the seller's discretion, be appended to the grade name, e.g. E. & W. No. 1 Size (2 in.).

‡ As measured clear within the bounds of the mesh.

quotations published in the Ministry's weekly *Agricultural Market Report* and in the annual *Agricultural Statistics*; hitherto, these quotations have been based on the stone of 14lb.

Co-operative Egg Marketing in Norway.—The recent establishment of the Norwegian Farmers' Co-operative Egg Export Association (Norske Eggcentraler S/L) marks a further stage in the growth of the co-operative marketing of eggs in Norway which began with the formation of the first of the "Egg Clubs" (Egglags) over 30 years ago.

The annual egg output of Norway is estimated at about 300 million eggs, of which about 25 per cent. are used by the producers themselves, while another 50 per cent. are consumed locally in the various producing districts. Practically the whole of the remainder are consumed in Oslo, the only large centre in a country of which the population is three-quarters rural. The importance to the Norwegian egg industry of good arrangements for marketing eggs in Oslo will be obvious, in view of the relatively large proportion of eggs consumed in that city, while the lack of large consuming centres means that any further increase in egg production in Norway must depend on the development of the export trade, which, up to the present, has been inconsiderable.* The object of the recently formed Norske Eggcentraler is to act as a wholesale central selling agency for the Co-operative Egg Marketing Societies so far as the sale of eggs in Oslo and the export trade are concerned.

Previous to 1929, the organization for the co-operative marketing of eggs in Norway consisted of seven "Egg Centrals," each of which was a limited liability association of co-operative egg clubs. A description of the working of the egg clubs, of which there were over 400 in 1925, handling over 11 per cent. of the total Norwegian production, is given in the Ministry's *Report on Egg Marketing in England and Wales*.† They undertake the assembling of their members' eggs, delivery to their respective Centrals, and the distribution of net proceeds to producers. Each club is separately incorporated and holds share capital in its Central at the rate of one share of Kr.10 for each of its members. The seven Egg Centrals, with headquarters, respectively, at Oslo, Bergen, Trondhjem, Skien, Arendal, Aandalsnes and Sandnes, grade and pack, and, until

* Only seven millions per annum on the average of the three years 1925 to 1927.

† *Economic Series No. 10*, pages 128 and 129.

recently, carried out the sale of, all eggs delivered to them by the clubs. The Egg Central at Sandnes is exceptional, in that it is run by only one egg club—Rogaland Egglag, the largest egg club in the country, with 40 receiving stations. This Central furnishes practically all the eggs which are at present exported and a large proportion of those sold in Oslo.

Norske Eggcentraler was established by the Egg Centrals in October, 1929, its capital being largely derived from a Government grant of Kr.225,000 made for the purpose of securing the formation of a central selling agency. The Norske Eggcentraler is a company with limited liability, membership of which is confined to the Egg Centrals, each of which subscribes one share of Kr.100 for every Kr.100,000 worth of eggs sold in Oslo or exported during 1928. The business of the company is conducted by a Board of three members elected by the federated Centrals at their annual meeting. The Board appoints a manager and staff, draws up rules for delivery and reception, sorting and packing of eggs, issues price quotations and provides for a proper system of accounts. The highest authority in the Company, however, is the meeting of "representatives" elected annually by the Centrals, each Central sending one representative for every Kr.250,000, or part thereof, of eggs marketed through the company. The representatives' meeting supervises the accounts of the Board, determines the disposal of the surplus, elects an auditor, and is responsible for any changes in the statutes of the company. Each affiliated Central has signed a five-years' membership contract, which binds it to market through the national Central all eggs intended for export or for sale in Oslo, and to conform to the instructions of the Board as to preserving, refrigeration, packing, dispatch, etc. Withdrawal from the company at the end of five years is dependent on six months' notice being given; subsequent withdrawal can take place at the end of each year with six months' written notice. Breach of contract by the affiliated Centrals may result in forfeiture of membership, with loss of shares and other rights.

The Centrals still perform a certain amount of selling, but they are confined, by the terms of their contract, to selling in their own allotted local districts. Any Central needing to purchase supplies to cover its local requirements does so through the Company, which obtains the necessary quantity from another Central which has a surplus. Eggs delivered to the company are paid for at the average price obtained in the week of sale, less an estimated deduction for expenses, any

surplus remaining at the end of the year, after provision has been made for reserve funds, being distributed among the Egg Centrals in proportion to the eggs marketed through the company.

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FEBRUARY ON THE FARM

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As this series of Notes will be contributed by another writer as from April next, it seems opportune to review some of the chief topics that have been discussed at various times during the six years which have elapsed since their commencement in January, 1924. On this occasion matters concerning land and crops will be dealt with, live stock topics being deferred until the March number.

Grass Land.—During the six years under review the value of certain old information has become better recognized and applied and progress has been made with new principles. Among the older principles may be mentioned systematic grazing, mechanical treatment, mowing rough places, and liming.

In the old practice of grazing fields in rotation, as described in June, 1924, the grazing area was divided into three or ~~four~~ enclosures or groups of enclosures, each occupied in turn by milkers and by followers, and then rested in periods of ten days. This practice tends to be modified by the use of more and smaller enclosures which may be eaten down in about five days.

Mechanical treatment, first discussed and advocated in these notes in March, 1924, has gradually gained recognition as an aid to the maintenance of a clean sward, as a means of accelerating the action of phosphates on rough turf; and, where vigorously pursued on matted grass land—as demonstrated at Hardwick Park—turf scarifying may effect a radical change in the botanical composition of the sward. Slitting the surface of pastures in winter may impart benefit simply by admitting moisture, where percolation is hindered by the presence of matted dead root fibres; but further benefit is derived by bringing up soil in the manner of worm castings. Severe mechanical treatment should be carried out only in the winter months and should be followed by heavy rolling to consolidate the surface. The renovation of old hide-bound

pastures by ploughing, liming, slagging and re-seeding with a mixture of seeds containing wild white clover, described in these notes in September, 1924, has been extensively tried and adopted, while the value of slag and wild white clover as a means of suppressing weeds has been similarly recognized.

The principal development in grassland knowledge, however, has been that concerning the value of nitrogenous top dressings. In July, 1925, I made the tentative suggestion—a heresy then—that the scarcity of keep which commonly occurs in summer, after the flush growth of May and June, might be prevented by the timely use of soluble nitrogenous fertilizers. In the following year a revolutionary experiment was carried out by Mr. W. Brunton on his farm near Middlesbrough, since when the use of nitrogenous manures on pasture land has become recognized as a valuable aid to intensive stock keeping.

The contentious question of the date of commencement of spring grazing was discussed in May, 1924, before we were prepared to recommend the forcing of early growth on pastures in the same way as Lothian farmers had for many years practised the stimulation of Italian rye-grass. The value of the early bite has now been amply demonstrated, and "Old May Day" may no longer be regarded as "Grass Day" for a farm run on progressive lines.

Periodical dressings of slag or other phosphates are still the ordinary basis of pasture improvement, and there is no doubt that expenditure under this heading yields a good return. In some cases, however, lime also is needed to maintain a clean, fresh sward, without which even old pastures suffer badly in a dry period.

Soil Cultivation.—One of the difficulties in writing about tillage operations is that of adjusting the separate objects of weed destruction and tilth formation; a second is that of foreseeing the effects which may be brought about by unexpected weather conditions. Frequently also the farmer's problem is that of making the best of a situation attributable largely to hindrances which he could not circumvent.

The value of early autumn skimming and cleaning has been frequently stressed. The common plough turning an intact furrow has been preferred to the digger for the work of laying up heavy land for the winter. Depth of ploughing has been regarded as a matter for consideration in each set of circumstances, deep work being advocated only in the autumn preparations for root crops and then only with caution.

Cross ploughing or ploughing back has been mentioned as advantageous on heavy land when it can be performed before the end of February.

Apart from the more obvious effects of ploughing—to loosen the soil, to cover weeds and to bury manure—the effect of inverting the soil is to rearrange the soil constituents, bringing the fine silt and clay particles up from below—where they tend to accumulate by the influence of percolating moisture and the sorting movement caused by tine implements. Recognition of this principle might help towards an understanding of why reploughing in spring may be desirable in some cases and not in others. In a district with heavy winter rainfall and on lightish land which is intended for turnips or potatoes, it may be beneficial to replough; on the other hand it seems to be agreed that, on heavy land to be sown early with mangolds or beet without spring cleaning, reploughing is inadvisable. In any case spring tillages must be carried out with due regard to conservation of soil moisture, evaporation being checked by rolling and mulching after ploughing.

From time to time advice has been given to commence spring tillages for roots with a preliminary surface stirring at an early date some weeks before the deeper cultivations proper. Confirmation of the success of this suggestion has been received from other counties. By this means and generally by preventing the drying of soil in lumps, clod-formation may be reduced.

The “heresy” about the damage to root fibres caused by deep horse-hoeing between the rows of root crops after about the middle of July has been tested widely and proved sound. The desirability of keeping a fresh loose surface on the soil is not questioned, but is emphasized by findings discussed in the notes for September, 1929.

Bare fallowing has been discussed as a practice still recognized as good husbandry in the management of heavy soils, where the suppression of weeds by ordinary autumn and spring tillage operations may not always be practicable. The aim in bare fallowing is to dry the soil, a condition that not only ensures the destruction of weeds, but also improves the texture of the soil and sets in motion certain chemical changes that favour crop growth. Heavy land can be dried, however, only when caused to form large clods, such as may be seen after April or May ploughing. Instead of leaving the land bare till this date, therefore, it is practicable to cultivate

a catch crop of Italian rye-grass for early spring feeding before the land is ploughed for fallowing. The rye-grass may be sown in the last corn crop or early in the autumn after corn harvest.

Crops.—Much space has been devoted to the soil preparations and sowing of the different crops under the varying conditions of each season. Only a very brief review is possible here.

Wheat.—Emphasis has been laid on the importance of forwardness in the preparations for this crop, which prefers a stale furrow, especially after leas. When necessarily sown late, a hardy variety should be chosen, such as Standard Red or Victor, a liberal allowance of seed should be sown, and the drilling should be shallow. Change of seed in this crop is mainly a matter of varieties and quality of sample. The dressing of seed with strong solutions of blue vitriol is out of date.

Oats.—The main essentials, apart from top dressing, are early sowing, liberal seeding of modern sorts, fairly deep drilling, and the avoidance of heavy rolling before the soil is dry. White winter oats are less liable to failure if sown after January 15 than when sown in October.

Seeds.—Mixtures for different purposes were prescribed in the notes for March, 1925, 1926 and 1927; and the various causes of failure of clover were discussed in April, 1924, and May, 1928, the value of a potash dressing in the nurse crop being emphasized in the latter year.

Green Crops.—A distinction has been drawn between mangolds and beet on the one hand and potatoes and turnips on the other: the latter may be regarded as cleaning crops in that they are tolerant of spring workings of the soil, provided that the seed bed is not worked too dry. Mangolds and beet, on the other hand, germinate badly on soil that has received much spring cultivation, unless a period of three or more weeks can be allowed to elapse between the completion of the workings and the sowing of the seed. For these reasons priority should be given to the land intended for the mangold and beet crop in the matters of autumn cleaning and early manuring. The cultivation of marrow-stem kale has been advocated on account of the reliability of this crop under different conditions, its weed suppressing properties, its response to liberal treatment, its tolerance of transplanting, and lastly its productivity and suitability for dairy cattle.

Weeds and other Crop Pests.—Some soils are prone to grow certain weeds ; liming and draining may be the means of gaining control over them. Other weeds are attributable to the system of cropping followed, couch and twitch as well as annual weeds being favoured by growing two corn crops in succession. Leaving leas down for two years may help to check thistles and coltsfoot, but unless the clover can be made to stand well in the second year, this method of cropping favours weeds of the grass family, unless the lea is broken up and pen-fallowed in June or July of the second year. On the other hand, long leas with a strong development of white clover, especially when closely grazed, may have an important cleaning effect, and some farmers are turning their attention to this scheme as a cheap means of cleaning heavy land.

Weeds are most abundant in thin corn crops, while dense growth of straw, such as may be induced by liberal top dressing with nitrogenous manures, strongly represses twitch and similar weeds. Charlock and other pests spread by seeding, germinate best in spring, autumn cleaning—valuable for other purposes—being rather disappointing as a means of eradicating this class of plant. Growing two green crops in succession is the time-honoured method of reducing the trouble ; spraying is an important aid ; but good can be done by spring tillages designed to destroy the seedlings. Ridges for root crops can be formed in time to allow of their being chain-harrowed down before drilling the root crop, but after they have been settled long enough for the weed seeds to germinate. Spring corn crops can also be drilled deeply so as to allow of a harrowing to destroy seedling weeds before the corn shoot appears.

Some of the troubles often attributed to insect and fungus pests are due mainly to unfavourable soil conditions. Wire-worms are frequently blamed for loss of plant when the main cause is lack of lime in the soil. The plant of mangolds and beet may be thinned off by insect pests, but soil acidity often aggravates the trouble.

NOTES ON MANURES

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Early Grass.—There is no need to stress the value of an early piece of pasture in spring. One of the services of the campaign towards the use of nitrogen on grass land has been to put this aspect of the case before farmers. The production of early grass by the use of fertilizers is naturally dependent on growing conditions. Either continued cold or, what is more unusual, continued dry weather will prevent any immediate effect from fertilizers. There is abundant evidence, however, that under normal conditions a dressing of available nitrogen will considerably hasten the growth of pasture in the early stages. The Park Grass plots at Rothamsted have shown this effect for many years. The plots receiving a nitrogenous dressing, either in the form of ammonium salts, nitrates, or even as farmyard manure, show a freshness and quick growth in early spring much greater than plots receiving no nitrogen. Under the rather intensive manuring of these plots it is frequently observed that the residues of previous years' treatments show up in this way before the current year's application has been made.

Although any form of nitrogenous manure may be used to produce this effect there is something to be said for the application of the less active forms of nitrogen for the earliest dressings, reserving the more active compounds for the opening of the vegetative season. Calcium cyanamide may be used for the earliest dressings, say in February, or even if desired in the previous winter; ammonium salts slightly later, or finally nitro-chalk or nitrates if the dressing has been further delayed. That is to say, the type of nitrogen may be chosen to suit the time of application. As far as ammonium salts are concerned, there is little chance of loss from grass land even if these are applied rather earlier than they can be expected to affect the plant. One hundredweight per acre of any of the above forms would be a suitable dressing for the purpose in view. The use of nitrogen in this way calls for due regard to phosphate and, in certain cases, potash dressings to maintain the quality of the herbage. Further, if it is used at all freely on soils poor in lime, sulphate of ammonia requires to be supplemented by appropriate dressings of chalk or lime.

Manures for Barley.—The results of a series of manurial trials on malting barley carried on in recent years under the

Research Scheme of the Institute of Brewing have shown that, while under certain circumstances phosphatic and potassic manures are valuable, the factor chiefly responsible for increased yields is nitrogen. One hundredweight of sulphate of ammonia produced on the average about 5 bushels more grain, the increase being remarkably consistent from year to year. Only one season, 1926, was exceptional in this respect. At the same time the quality of the barley was not appreciably affected by nitrogen in the above amount. Only in 1926, when the yield increase produced by nitrogen was unusually small, was the quality distinctly depressed. With our modern varieties of barley it is therefore permissible to give a light dressing of nitrogenous manure, say 1 cwt. sulphate of ammonia per acre, provided that it is known that phosphoric acid and potash are also present in sufficient quantity, either as residues of previous treatments or in the form of supplementary manures. Needless to say the crop must not be lodged.

The above views have found interesting confirmation in the results of some extensive trials on the effect of increasing dressings of nitrogen on barley recently carried out in Germany at München. The soils were light, the plots in triplicate, and some fourteen varieties of barley were compared each year. A good dressing of phosphate and potash was supplied in all cases, approximately 3 cwt. of high grade basic slag and $1\frac{1}{2}$ cwt. of muriate of potash. The nitrogen was supplied as sulphate of ammonia, four different quantities being compared with no nitrogen.

The experiments were repeated for several seasons and the results discussed individually. A general view may be obtained by taking all years together. Converting the original figures into English measure, some of the results are given in Table I.

TABLE I.—MEAN OF FOUR SEASONS, 1925–28 (all varieties taken together).

<i>Treatment per acre</i>	<i>Grain Bushels</i>	<i>Successive Increases</i>	<i>Straw cwt.</i>	<i>Parts</i>	
				<i>Successive Increases</i>	<i>Grain to 100 Straw</i>
Basal only (no Nitrogen)	35.3	—	25.2	—	70
Basal + 1 cwt. sul./amm. (22.4 lb. N)	45.6	10.3	36.9	11.7	62
Basal + $1\frac{1}{2}$ cwt. sul./amm. (35.7 lb. N)	52.0	6.4	42.4	5.5	58
Basal + 2 cwt. sul./amm. (49.1 lb. N)	55.2	3.2	48.6	6.2	57
Basal + $2\frac{1}{2}$ cwt. sul./amm. (62.5 lb. N)	59.7	4.5	52.9	4.3	56

These results show that the barley was highly responsive to nitrogenous manuring both in grain and straw. The straw was

increased relatively more than the grain and it was found that the two highest dressings usually lodged the crop to a greater or less extent. As far as the effect on the nitrogen content of the grain was concerned the following data (calculated from the figures for crude protein) are given in Table II.

TABLE II.—MEAN OF FOUR SEASONS (1925–28) (all varieties).

Lb. of N. in Manure	<i>Per cent. in Grain</i>		<i>No. of Cases in which N. was increased</i>
	<i>Crude Protein</i>	<i>N.</i>	
0	10.78	1.72	7 cases out of 59
22.4	10.12	1.62	—
35.7	10.37	1.66	13 cases out of 58
62.5	10.93	1.75	23 cases out of 50

It will be seen that the first two dressings of nitrogen tended to decrease rather than to increase the nitrogen content. The heaviest application increased it slightly. The conclusions were that on light soils in not too high condition the use of sulphate of ammonia up to the level of the second application, 1½ cwt. per acre, was well justified both in respect of yield and quality. The dose of nitrogen must be so measured as to avoid lodging the crop. On considering the varieties individually it was found that some of them had the power of responding to generous treatment to a greater degree than others.

Spring Oats.—The manurial treatment of spring oats differs in certain respects from that of barley. In the first place the relations of the two crops to soil acidity are different. The oat crop is less sensitive to a moderately acid soil than is barley. It can, therefore, be grown without lime in situations when barley might suffer. Further, although the nitrogenous application must be carefully adjusted to barley if a malting sample is aimed at, a little more latitude is permissible in the case of oats because the accumulation of protein in grain and straw is a gain in feeding value. The same holds also for barley if it is grown definitely for feed purposes, a good malting sample having about 9 per cent. of crude protein while a feed sample from rich soil or heavy manuring may contain 14 per cent.—a difference of 1 cwt. of crude protein for each ton of barley meal fed. An early start and rapid tillering is a great advantage for spring oats in order to enable the plant to withstand the attacks of frit-fly. To induce this the manures should be applied at sowing time, and might consist of a mixture of from 1 to 2 cwt. of sulphate of ammonia, 2 cwt. of superphosphate, and up to 1 cwt. of muriate of potash, according to the nature and con-

dition of the soil. Where oats follow a rich temporary ley the nitrogen may have to be reduced or omitted entirely and the phosphate increased. On stiff land potash may be unnecessary, while a high soluble basic slag may be substituted for superphosphate if there is any reduction in cost by doing so.

Fertilizers and Weeds.—The most usual way in which manures favour the suppression of weeds is by enabling good smothering crops to be grown. A well measured dressing of nitrogenous manure will often enable a good plant so to fill out and cover the ground that few weeds can make headway below it. The “scorching” action of most soluble fertilizers when left in contact with the leaves of crops, observed for example when top dressings of nitrate of soda or sulphate of ammonia have lodged on the tops of mangold or sugar beet, has also been turned to account in combating weeds. The effect consists in the abstraction of water from the leaf cells by the strong solution which is formed when the fertilizer dissolves in a trace of moisture on the surface of the leaf. If a sufficient leaf area is damaged in this way the plant is killed. A special grade of finely divided kainit is used for this purpose, principally against charlock, although several other species of weeds are damaged. It is best applied as a dust cloud while the leaves are covered with dew and hot weather is likely to follow. This can be done even when the weed is growing in corn, for the upright waxy leaves of the cereals suffer little permanent damage from the treatment. A strong solution of sulphate of ammonia has been used to some extent for the same purpose, but applied as a liquid spray in bright weather. A further case is the utilization of the caustic properties of calcium cyanamide. The bad effect of this manure on germinating seedlings, guarded against as far as the crop is concerned by applying it a few days before the sowing, no doubt eliminates a number of weeds whose seeds happen to be at a vulnerable stage. Moreover, the burning effect of this fertilizer on foliage is used against charlock and other weeds in corn by broadcasting dusty cyanamide, by means of a “blower” or dry sprayer, under the same conditions as are required for kainit. In addition to damaging weeds the above substances also exert a good measure of their usual fertilizing effect, which may in itself justify their application.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended January 15.				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	10 0d	10 0d	10 0d	10 0d	12 11
Nitro-chalk (N. 15½%) ..	9 19d	9 19d	9 19d	9 19d	12 10
Sulphate of ammonia:—					
Neutral (N. 20·6%) ..	10 0d	10 0d	10 0d	10 0d	9 9
Calcium cyanamide (N. 20·6%)	9 2e	9 2e	9 2e	9 2e	8 10
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%) ..	..	10 10h	..	..	..
Kainit (Pot. 14%) ..	3 6	2 19	2 19	3 3	4 6
Potash salts (Pot. 30%) ..	5 3	4 18	5 0	4 19	3 4
" (Pot. 20%) ..	3 15	3 9	3 8	3 11	3 7
Muriate of potash (Pot. 50%)	9 17	9 3	9 2	9 5	3 8
Sulphate,, " (Pot. 48%)	11 19	11 6	11 5	11 5	4 8
Basic Slag (P.A. 15½%)||	2 13c	2 3c	..	2 9c	3 1
" (P.A. 14%)||	2 7c	1 16c	1 16c	2 3c	3 2
" (P.A. 11%)||	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26-27½%)||	2 2a	2 10a	2 5a	2 2a	1 7
Superphosphate (S.P.A. 16%)..	3 11	..	3 6	3 6	4 2
" (S.P.A. 13½%)..	3 5	2 18	3 0	3 0	4 4
Bone meal (N. 3½%, P.A. 20½%)	8 15	8 10	8 12	8 2	..
Steamed bone flour (N. ½%, P.A. 27½-29½%) ..	5 17b	..	6 10	5 2	..
Burnt Lump Lime ..	1 8k	1 10l	1 11n	2 2m	..
Ground Lime ..	1 12k	..	..	1 17m	..
" Limestone ..	1 3k	..	1 8n	2 6m	..
" Chalk ..	..	1 6	..	1 11m	..
Slaked Lime ..	..	..	2 12n	3 2m	..

Abbreviations: N.—Nitrogen; P.A.—Phosphoric Acid; S.P.A.—Soluble Phosphoric Acid; Pot.—Potash.

* Prices are for not less than 6 ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‡ Fineness 80% through standard sieve. § Prices for 6-ton lots f.o.r. at makers' works.

|| Delivered (within a limited area) at purchaser's nearest railway station.

¶ Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

‡ For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

§ Delivered in 4-ton lots at purchaser's nearest railway station

¶ F.o.r. Goods.

‡ 6-ton lots f.o.r. Bristol: ground limestone 98.95% through standard sieve.

|| F.o.r. Kewstingley.

¶ 6-ton lots delivered London district, ground limestone 65% through standard sieve. Ground limestone, ground chalk and slaked lime in non-returnable bags.

‡ 6-ton lots delivered Liverpool stations, ground limestone 45% through standard sieve. Ground limestone and slaked lime in non-returnable bags.

NOTES ON FEEDING STUFFS

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Water.—The cheapest thing that animals need to swallow is water, and yet it is the most important. This is very obvious, for everyone knows that death from thirst occurs earlier than death from hunger, but what is sometimes insufficiently realized is that even a moderate shortage of water has ill-effects, long before it appears to affect the health of animals, or even before they show any signs of discomfort. As soon as we start looking into the working of the animal body we see that water plays an extremely important part in all vital processes: mastication and swallowing need its presence, and recent researches on the subject of rumination (chewing the cud) which have been carried out in America show how dependent the operation is on a plentiful supply of liquid. On arrival in the stomach and intestines the food meets several digestive fluids which reduce its nutrients to assimilable form, and these must all be in their right concentration—that is to say they must contain their rightful proportion of water. The next step in digestion is the absorption of the products of the action of the fluids through the gut wall, so that they may be transported to the tissues which are to deal with them, and this process also depends on the presence of sufficient water—indeed, if it is lacking, water will be drawn out of the gut wall with more or less disastrous results. Eventually the waste products of metabolism must be excreted from the body, and this is done by getting rid of them in solution in water, *via* the kidneys. The transport of all substances and gases (oxygen and carbon dioxide) from one part of the body to another is done by the blood, and the concentration of this must only vary within very narrow limits, so that a shortage of water, which will tend to thicken it, will have harmful results in all parts of the body. In addition, one important property of the body is that it can keep its temperature remarkably constant under all varieties of circumstances, and in this mechanism water plays an important part, as much heat is dispersed by the evaporation of water from the surface.

The mere mention of some of the fundamental physiological processes in which water figures prominently is sufficient to show how high is its place in the internal economy of the animal, and how severely efficiency will be impaired by even the slightest shortage. Presumably animals with water con-

tinually before them will not suffer in this respect, but it has been stated that they do not drink sufficient even under those conditions, and this is commonly believed to be true of human beings (that is, as regards water). It has been claimed by those who favour root feeding that one of the advantages gained is that the animals take in the roots a quantity of water that will raise their total consumption above what it would otherwise be. On the other hand, it is stated that if animals consume too much water, as can be brought about by feeding salt, they will eventually become flabby in their tissues, less efficient in digestion and more prone to disease; under ordinary conditions, however, this condition will not arise.

The water required by an animal will be largely affected by the type of food it is given, a fact that has been clearly demonstrated in trials. Dry foods have first of all to be thoroughly moistened in the stomach, and in this they will take up varying quantities of water.

Experiments have been made on this question by Proctor and Wright at Reading, and their work seems to open up a new viewpoint on the bulk question which has loomed so large in the literature of recent years. The point that has been stressed is that a ration must be within the power of the animal to consume, and at the same time must be sufficiently bulky to satisfy its appetite. With this fact in mind scientific feeders have always felt the need of some measure of the bulkiness of a ration, and the method adopted is that of dry matter—that is to say, standards have been drawn up giving the optimum amount of dry matter that various sorts of animals should eat daily, in the belief that the dry matter is a good measure of the volume the foods will occupy in the animal's body. Of late these standards have been applied most rigidly. Proctor and Wright set out to test this basis for computing bulkiness by soaking various foodstuffs in water at body temperature, and seeing to what extent they swelled; the variation was very large indeed between different foods, as is shown by the following extracts from one of their tables:—

<i>Food</i>	<i>Volume in c.c. of 10 gm. dry matter</i>		<i>Per- centage Swelling</i>
	<i>Dry</i>	<i>Wet</i>	
Linseed Cake	25.5	88.0	245.0
Coconut Cake	27.5	88.0	220.0
Decorticated Ground Nut Meal	17.5	43.5	148.0
Decorticated Cotton Seed Cake	16.0	39.0	144.0
Bean Meal	19.5	37.5	92.5
Palm Kernel Cake	24.0	45.0	87.5

<i>Food</i>	<i>Volume in c.c. of 10 gm. dry matter</i>		<i>Per- centage Swelling</i>
	<i>Dry</i>	<i>Wet</i>	
Maize Meal	18.0	32.5	81.0
Brewer's Grains	32.0	57.0	78.0
Wheat Sharps	21.5	37.0	72.3
Barley Meal	23.0	37.0	61.0
Rice Meal	23.0	32.0	39.2

In the current view 10 gm. of dry matter is considered as representing one and the same amount of bulk, no matter in what food it is contained; the above extracts show how false this view is. In the *dry* state the volume occupied by 10 gm. may vary from 16 c.c. to 32 c.c.; whilst when *soaked* at body temperature—that is under conditions comparable to those in the animal stomach—they may vary from 32 c.c. to 88 c.c. One pound of dry matter in linseed cake takes up nearly three times as much of the animal's accommodation as does 1 lb. of dry matter in rice meal.

These results suggest almost revolutionary changes in the manner of calculating bulk; much has been said of the discomfort caused to animals by overloaded stomachs, and of the loss of efficiency caused thereby, but it would appear that our methods of avoiding this sad state of affairs are all wrong. Great pains are taken to adjust the dry matter of the ration with much exactitude, but such a procedure is shown by these results to be a case of misdirected effort, if the object is to fill the stomach without distending it. If bulkiness is what we really aim to control, further trials of this nature must be carried out, and the results be incorporated into practice in substitution for the dry matter idea. It is significant that Mr. Boutflour, the arch-priest of bulk, should have formed so high an opinion of rice meal, which as shown above occupies such a relatively small space in the soaked state.

Proctor and Wright carried their researches a stage further by testing the effects of high-swelling and low-swelling mixtures on the appetites of animals. In the case of pigs they found that much more dry matter was consumed in the case of rations that swelled comparatively little on soaking, than of rations whose soaked volume was high. With calves no definite results were obtained, and this they attributed to the powers of distension of the stomach, which is, of course, of greater relative size than with pigs. The whole question is worthy of much further study, and it is to be hoped that it will be probed deeper in the near future, so that our ideas of bulk may be put on a firmer basis, and that reasonable methods for its control may be devised.

In American trials with fattening bullocks it was found that the water drunk varied between 56 and 91 lb. per day, being strongly influenced by the ration fed. Some farmers in this country, who fatten cattle on rations containing very large quantities of roots, do not provide them with any water at all, but this practice is not to be recommended. If sufficient water is to be consumed in roots they must be fed in amounts too large for efficient digestion, and though a moderate root ration may be beneficial in raising the total water intake, roots should not be provided as the main means of supplying it, as other methods are decidedly cheaper.

Heavy yielding cows drink much more water than other animals, and need from three to four gallons for every gallon of milk they produce, and sometimes more, especially in summer when evaporation plays a bigger part. It is well known that withholding water from cows causes a decline in milk yield, and this method is sometimes used to help in drying off a cow when difficulty is experienced. There would seem to be no fear of watering milk through the cow, although a prosecution has been made in the French courts on the ground that a farmer had adulterated his milk by causing his cows to drink large quantities of water and thereby increasing the yield at the expense of the composition. Trial at the Midland Dairy College, however, showed that excessive water consumption had no effect in this way. (This JOURNAL, February, 1911.)

Though the daily consumption of water by cows must be large, experiments that have been made on the effect of the frequency of watering seem to show that they have an extraordinary adaptability in the amount that they can drink at one opportunity. There were published in this JOURNAL two years ago (January, 1928) the results of an experiment that was run during two winters at four centres in this country, comparing the effect of water bowls continually before the cows with watering twice daily. The increase in yield with water-bowls was only 1 per cent., which cannot be regarded as sufficiently definite to show any advantage in their favour ; on the other hand it is interesting to notice that in this experiment the cows that were changed over from water-bowls to watering twice daily gave lower yields during the first one or two days, though they quickly came back to their previous level. This means that after having water continually before them they did not make the fullest use of their visits to the water troughs, with consequent detrimental effect on their

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.	£ s.	s. d.	d.	%
Wheat, British.. ..	—	—	10 3	0 12	9 11	72	2 8	1.43	9.6
Barley, British feeding ..	—	—	7 5	0 9	6 16	71	1 11	1.03	6.2
" American	26 0	400	7 5	0 9	6 16	71	1 11	1.03	6.2
" Danubian	27 3	"	7 13	0 9	7 4	71	2 0	1.07	6.2
" Persian	25 0	"	7 0*	0 9	6 11	71	1 10	0.98	6.2
" Tunisian	26 0	"	7 5†	0 9	6 16	71	1 11	1.03	6.2
Oats, English, white	—	—	7 10	0 10	7 0	60	2 4	1.25	7.6
" " black and grey ..	—	—	6 10‡	0 10	6 0	60	2 0	1.07	7.6
" Canadian mixed feed ..	19 6	320	6 17*	0 10	6 7	60	2 1	1.12	7.6
" Argentine	19 9	"	6 18	0 10	6 8	60	2 2	1.16	7.6
" Chilean	21 0	"	7 7	0 10	6 17	60	2 3	1.20	7.6
" German	22 9	"	8 0	0 10	7 10	60	2 6	1.34	7.6
Maize, Argentine	31 9	480	7 8	0 9	6 19	81	1 9	0.94	6.8
" South African	33 6	"	7 17‡	0 9	7 8	81	1 10	0.98	6.8
Beans, English winter	—	—	9 5†	1 4	8 1	66	2 5	1.29	20
" Chinese	—	—	9 17‡	1 4	8 13	66	2 7	1.38	20
Peas, English blue	—	—	10 2†	1 1	9 1	69	2 7	1.38	18
" Japanese	—	—	17 15‡	1 1	16 14	69	4 10	2.59	18
Dari	—	—	8 15†	0 11	8 4	74	2 3	1.20	7.2
Millers' offals—									
Bran, British.. ..	—	—	6 2	1 1	5 1	42	2 5	1.29	10
" broad	—	—	7 0	1 1	5 10	42	2 10	1.62	10
Middlings, fine, imported ..	—	—	7 0	0 17	6 3	69	1 9	0.94	12
" coarse, British	—	—	6 2	0 17	5 5	58	1 10	0.98	11
Pollards, imported	—	—	5 12	1 1	4 11	60	1 8	0.89	11
Meal, barley	—	—	8 15	0 9	8 6	71	2 4	1.25	6.2
" maize	—	—	8 17	0 9	8 8	81	2 1	1.12	6.8
" " South African	—	—	8 0	0 9	7 11	81	1 10	0.98	6.8
" " germ	—	—	8 10	0 15	7 15	85	1 10	0.98	10
" locust bean	—	—	9 5	0 7	8 18	71	2 6	1.34	3.6
" bean	—	—	11 15	1 4	10 11	66	3 2	1.7	20
" fish	—	—	19 0	3 4	15 16	53	6 0	3.21	48
Maize, cooked flaked	—	—	10 0	0 9	9 11	83	2 4	1.25	8.6
" gluten feed	—	—	9 7	0 19	8 8	76	2 3	1.20	19
Linseed cake, English, 12% oil ..	—	—	13 10	1 8	12 2	74	3 3	1.74	25
" " " 9% "	—	—	12 15	1 8	11 7	74	3 1	1.65	25
" " " 8% "	—	—	12 10	1 8	11 2	74	3 0	1.61	25
Soya bean cake, 5½% oil ..	—	—	11 0†	1 19	9 1	69	2 7	1.38	36
Cottonseed cake—									
English, 4½% "	—	—	6 15	1 7	5 8	42	2 7	1.38	17
" " Egyptian, 4½% " ..	—	—	6 5	1 7	4 18	42	2 4	1.25	17
Decorticated cottonseed meal, 7% oil	—	—	11 12*	2 0	9 12	74	2 7	1.38	35
Coconut cake, 6% oil	—	—	10 5	1 4	9 1	79	2 3	1.20	16
Ground-nut cake, 6.7% oil ..	—	—	9 15*	1 6	8 9	57	3 0	1.61	27
Decorticated ground-nut cake, 6.7% oil	—	—	12 7*	2 0	10 7	73	2 10	1.52	41
Palm kernel cake, 4½-5½% " ..	—	—	9 5†	0 17	8 8	75	2 3	1.20	17
" " " meal, 4½% " ..	—	—	9 15†	0 17	8 18	75	2 4	1.25	17
" " " meal 1.2% oil ..	—	—	8 12†	0 17	7 15	71	2 2	1.16	17
Feeding treacle	—	—	6 7	0 9	5 18	51	2 4	1.25	2.7
Brewers' grains, dried ale ..	—	—	7 15	0 17	6 18	48	2 11	1.56	13
" " " porter	—	—	6 17	0 17	6 0	48	2 6	1.34	13
Malt culms	—	—	8 10‡	1 6	7 4	43	3 4	1.78	16

* At Bristol.

† At Hull.

‡ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of December and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.49d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 8s. 8d.; P₂O₅, 3s. 5d.; K₂O, 3s. 3d.

yield, but that they rapidly accommodated themselves to the new conditions and then drank sufficient, even with only two opportunities a day. These cows were being fed on rations containing from 20 to 40 lb. of roots.

As soon as water is swallowed it has to be warmed up to the temperature of the body, and it can well be realized that in cold frosty weather the heat required to raise anything up to 10 gallons or even more water from freezing point to body temperature is very considerable. In general the body has a lot of heat to spare, because in the case of all foods (particularly

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	7 6
Maize	81	6.8	7 12
Decorticated ground nut cake	73	41.0	12 7
„ cotton cake	71	34.0	11 5

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1.83 shillings, and per unit protein equivalent, 3.04 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The “food values” which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	8 1
Oats	60	7.6	6 13
Barley	71	6.2	7 9
Potatoes	18	0.6	1 15
Swedes	7	0.7	0 15
Mangolds	7	0.4	0 14
Beans	66	20.0	9 2
Good meadow hay	37	4.6	4 2
Good oat straw	20	0.9	1 19
Good clover hay	38	7.0	4 11
Vetch and Oat silage	13	1.6	1 9
Barley Straw	23	0.7	2 4
Wheat straw	13	0.1	1 4
Bean straw	23	1.7	2 7

roughages) a certain proportion of their energy automatically goes to produce heat during digestion, and cannot be used for purposes of production. If, therefore, water were being drunk in small quantities at short intervals it is probable that the heat used up in this way would not be missed—it would merely be that which would otherwise be dissipated at the surface of the body. If, on the other hand, a heavy milking cow is only watered once or twice a day, and then takes in large quantities of ice-cold water, it may be that the available heat at the moment is insufficient to warm it up to body temperature, and then expensive foodstuffs have to be burnt up in the body to provide it. Under certain conditions it might, therefore, be advisable to take the chill off water before supplying it to dairy cows, but probably the better and cheaper way is to avoid large drinks by watering fairly frequently—twice a day should at all times be regarded as the very minimum for milking cows, although dry cows might suffer no harm if it were only once, except during hot weather.

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POLICY OF THE NATIONAL INSTITUTE OF AGRICULTURAL BOTANY

E. S. BEAVEN, LL.D.,

Chairman of the Council of the Institute.

[The following review of the present policy of the National Institute of Agricultural Botany was given by Dr. E. S. Beaven at a meeting of the Council of the Institute held on December 13, 1929.]

WE have now adopted this, the Tenth, Report of the Council, which has been prepared for our approval by the Director and the Staff of the Institute and it becomes my duty and privilege on concluding my term of office as Chairman of the Council to review briefly the present policy of the Institute. I shall refer more especially to the work and policy of the Crop Improvement Branch, although that forms only one part of our activities. Its "aims and work" are:—

First:—"To discover by field trials and observation plots which varieties, old or new, of the principal agricultural crops are the most remunerative to grow in the different districts of

England under conditions of normal and intensive manuring and to bring the results to the notice of farmers."

Second :—"To set on foot joint action for getting rid of cereal synonyms." I personally regard this as a very useful, yet minor, matter, and we may hope that the action we are taking within the next few weeks may do all that is either necessary or possible."*

Third :—"To grow on and market, through the Trade, new varieties—if the trials show that they merit introduction."

Now this is an inversion of the order of our original aims. Ten years ago the founders of this Institute put the above third object in the foreground and no doubt they confidently believed that it would be the main object of the Institute. After thirty years of not altogether unsuccessful experience of plant breeding as an amateur, I did not share that expectation. The Institute, as a matter of fact, has distributed only one new variety and that was only a modified form of an older variety already in cultivation.

The production of new and distinct races of cereals which can survive systematic trials and be shown to be more useful than those already in existence is as difficult as is the production of distinct new and improved races of farm animals. It has very rarely been profitable to those who have undertaken it if they have conscientiously determined not to distribute what are in reality inferior races. Whilst there are hundreds of successful breeders of what may be called luxury plants, such as flowers and fruits and also of vegetables, in respect of the most important farm plants, the cereals, I believe the number of those who are at present engaged in systematic breeding in this country may be numbered on the fingers of one hand. This is not a suitable occasion for elaborating this view, and what follows from it, but let it be remembered that it takes 12 or 14 years to raise a stock of any new cereal to the point when distribution can commence if a systematic method of testing its value is adopted. My own experience is that less than one in five hundred of original nursery cultures survives such tests, even when one has some expert knowledge of the kind of plant one is dealing with. It is not

*See also p. 1115 of this issue of this JOURNAL.

surprising, therefore, that the originally most prominent object of this Institute has not had spectacular success. No better illustration could be afforded than the history of the two new races of barley numbered "824" and "825" referred to in our report. These numbers themselves suffice to show that the original cultures had been selected from a very large number of others. I can testify from some knowledge of barley and from close observation of the trial cultivations during the past five years by the Institute that these two races were in the front rank of races of barley. Yet in the opinion of both the Plant Breeding Institute, which originated them, and of your Crop Improvement Committee, the trials proved that—to use the words of our Report—"on the basis of monetary return per acre they showed no superiority over the two other well-established races" with which they had been compared in the five years' series of trials; and we take credit to ourselves, as a Crop Improvement Committee, for upholding the Institute's unvarying policy to market no new variety unless there is clear proof of its superiority to races already in cultivation in respect of probable monetary value to growers.

We of the Crop Improvement Committee, therefore, fall back then upon what we now regard as one of the most important of our functions, which is, briefly, the testing by systematic and repeated trials at our headquarters and sub-stations in six different locations—all in corn-growing areas—of the relative merits of different races of farm-plants. We were not the first to carry out extensive and prolonged trials of this kind, but we do claim to be the first institution in this country to carry them out in the systematic manner which alone yields reliable and conclusive results. In other countries, notably in Ireland and Denmark, the methods which we have adopted, and have elaborated and improved upon, had already been proved to be effective for their purpose and to have led to marked increase in the value of the crops of those countries and repaid a thousandfold the effort and expenditure involved. Our methods have been very fully described and the results tabulated and summarized in our Reports.

There are some who think it may be a matter of regret that we have not sufficiently—to use the words of your Report—"brought the results to the notice of farmers"—and here perhaps we may improve as time goes on.

Let us consider for a moment some more serious objections which have been raised in some quarters. First, it has been

said that these extensive and systematic trials of ours come to maturity too late, and that we only pronounce judgment against inferior races of farm-plants after they have spread about the country. The answer is that we cannot do impossibilities and we have no power to stop the distribution of inferior varieties whether they originate at home or are importations from abroad. It takes time to carry through conclusive trials. We go on with them as fast as our resources permit.

Secondly, with respect to good new varieties it has been said that farmers find out for themselves quickly enough which are the best sorts and that the information we give them as to relative values in respect of yield or quality, translated into "value per acre," of the good races such as, for instance, Yeoman wheat, Spratt-Archer barley, or Abundance oats, they have already found out for themselves. There is some truth in this, but it is not "the whole truth and nothing but the truth." Farmers do not and cannot by any means available to them always find out these things for themselves and they are sometimes conservative and it is even whispered that they are sometimes influenced by the specious statements of enterprising salesmen. It is, indeed, against all we know of human nature not to believe that when a grower has bought a few bushels, for instance, of a new foreign variety of wheat named, shall we say, "World's Masterpiece," and has, owing to exceptional conditions and extra good cultivation, grown 10 qrs. of it to the acre—it would be against human nature if he did not offer it to his brother farmers for seed. But stocks of seed which give exceptional crops under exceptional conditions do not necessarily transmit high yielding capacity. That the statement is not the whole truth is well shown by reference to one variety of barley, viz., Spratt-Archer, which went into cultivation ten years ago. At present, as far as can be judged from the number of samples sent to our Seed Testing Branch, and from other evidence we have, Spratt-Archer forms somewhere about 15 per cent. of the total barley of this country. I will risk any reputation I may have for some knowledge of barley by saying that on its merits it ought to occupy about three times its present area, and this is fully confirmed by the trials which we have carried out during the past five years. That disposes of one of these half-truths.

Another criticism which is made upon our Crop Improvement work is that it costs more public money than it is worth.

Let us examine this criticism very briefly. We spend upon this work about £2,000 of our own money, representing interest on our investment of the contributions of those who started the Institute, rents, Fellowship fees, and some outside voluntary subscriptions. We receive £4,500 from the Development Fund on the recommendation of the Ministry of Agriculture, and in addition the Ministry supports six sub-stations, which are partly occupied in carrying out our trials. That £4,500 and the part cost of the sub-stations is taxpayers' money, and it would, in my humble opinion, be much better if we could get on without it. But let us have some sense of proportion and make some comparisons. The total exchequer grants in aid of Agriculture directly and indirectly are over £6,000,000 per annum. The contribution to our crop improvement work is about one-tenth of one per cent. of this. Is that an out-of-proportion amount in aid of one of the most important branches of agricultural research? Every political party prides itself on supporting Agricultural Research, and surely the ascertainment of the most profitable sorts of agricultural plants is a useful research. The United States of America spends in proportion to its arable area and in proportion to its agricultural population about ten times as much of taxpayers' money as this country does in precisely the same kind of Crop Improvement Work which we carry on. I have made a careful study of their work on Varieties and Races of Barley. They have carried out trials of over 800 different races of Barley at 63 different stations, in some cases for over 30 years past. They have 49 fully equipped Agricultural Experiment Stations, and each of these receives in grants of taxpayers' money between £15,000 and £20,000 annually. Moreover, a considerable increase in future grants has been provided for. Our expenditure on the particular kind of work the N.I.A.B. carries on in comparison with theirs, after allowing freely for their greater area and population, is trivial. The Agricultural Experiment Station of the small State of Connecticut with a population about that of the County of Essex gets grants of over £20,000 a year, of which £2,000 is spent on field trials of one only of their farm plants, viz., tobacco.

Finally, is our expenditure excessive in relation to the object we aim at: "Better Seeds, Better Crops"? The records of our trials show, as has never been shown so conclusively before, that there are frequently differences of anything between 10 and 20 per cent. in the values of crops due to the

variety or race of the seed sown—when all other conditions are equal. It is a modest estimate that something over 5 per cent. would be added to the monetary return of the arable farmers of the country if they all grew the races of plants best suited to their localities and soil conditions. That would add about £2,000,000 every year to the net returns for arable farm produce. We may not be able to bring about such a result within the lifetime of any of us, but if by efforts such as we are making it takes 100 years to accomplish that result, then in one single year the whole of the public money which will have been spent will be more than repaid with interest.

We realize how very small is the contribution any of us can make towards a remedy for the present deplorable depression in arable farming. We know that ours is a relatively small contribution, but we claim that it is a useful contribution. I conclude by repeating the words of my predecessor in this Chair—"The Institute has found ways in which it can best help farmers. It has built up the necessary machinery, and is now fulfilling confidently and with vigour its allotted task."

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CEREAL SYNONYMS

A CONFERENCE arranged by the National Institute of Agricultural Botany with the assistance of the Royal Agricultural Society of England and the National Farmers' Union, was held at the offices of the last-named on January 8, 1930, to discuss the question of cereal synonyms and means of eliminating them. Delegates attended from these three bodies, and from the Agricultural Seed Trade Association and the National Association of Corn and Agricultural Merchants, the names being :—

National Institute of Agricultural Botany

Dr. E. S. Beaven.
Mr. F. L. Engledow.
Mr. W. Hasler.
Dr. H. Hunter.
Mr. W. H. Parker.

Royal Agricultural Society of England
Sir Rowland Biffen.

National Farmers' Union

Mr. J. M. Eady.
Mr. E. W. K. Slade.
Mr. R. Stratton.
Mr. R. W. Tuddenham.

National Association of Corn and Agricultural Merchants

Mr. E. J. Small (of Messrs. G. Small & Sons, Ltd.).

Mr. H. F. Smith (of Messrs. McGill & Smith).

Colonel Temperley (of Messrs. W. A. Temperley & Co.).

Agricultural Seed Trade Association

Captain Clayton (of Messrs. Edward Webb & Sons (Stourbridge), Ltd.).

Mr. G. H. Dicks (of Messrs. Cooper, Taber & Co., Ltd.).

Mr. T. E. Miln (of Messrs. Gartons, Ltd.).

Mr. W. G. Toogood (of Messrs. Toogood & Sons, Ltd.).

The subject was thoroughly discussed, and the following resolution was unanimously adopted :—

“ This Conference called by the National Institute of Agricultural Botany and consisting of :—

Representatives of that Institute,
of the Royal Agricultural Society of England,
of the National Farmers' Union,
of the Agricultural Seed Trade Association, and
of the National Association of Corn and Agricultural Merchants

unanimously agrees :—

- (1) That it is undesirable in the interests alike of agriculturists, plant-breeders and the seed trade that stocks of Wheat, Barley and Oats sold for seed which are of identical origin and character should be sold under different names.
- (2) That the name under which such stocks are sold should be that given by the original producer.
- (3) That in cases where a stock of an existing variety has been re-selected by a grower subsequent to its introduction, the original name should be retained with the addition of words indicating that the offered stock has been raised by selection.
- (4) That a standing committee of reference should be established who should report to the Associations represented at this Conference whenever they have sufficient evidence that these recommendations have been infringed.
- (5) That the standing committee consist of one representative of each of these five Associations and of the Cambridge University Plant Breeding Institute to be nominated yearly and to meet once a year when called together by the Secretary of the N.I.A.B., to whom is to be sent any complaint of infringement of these recommendations to be laid before the Committee, who should then proceed to consider whether the evidence produced justifies the complaint.
- (6) That no report on any complaint should be made unless four out of six of the representatives of the above-mentioned Associations concur in the same.”

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CEREAL CROPS IN ESSEX, 1927-28

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IN this JOURNAL for January, 1929, some account was given of the first attempt made on any considerable scale in this country to compare the merits of varieties of cereals on the basis of the results obtained by farmers from their ordinary field crops. Mr. J. B. Gill, Secretary of the Essex County Farmers' Union, provided the material by collecting from some 150 members of the Union records of their crops in 1926-27. He and the Essex farmers have now followed this up by providing records for 1927-28 from 622 fields, representing in area nearly 4 per cent. of the cereal acreage in the county. Apart from differences directly due to the greater severity of the second winter, the results of the two seasons agree satisfactorily. The principal figures are here given for each crop in turn and the conclusions to be drawn from them are briefly suggested in the accompanying paragraphs.

Winter Wheat.—For the second year Yeoman, Yeoman II and Victor (or Wilhelmina, which closely resembles the last) ran neck and neck for first place. Save in exceptional circumstances these varieties are probably the most profitable in Essex. Between them they cover 41 per cent. of the winter wheat area of the farms concerned; Little Joss and Squarehead's Master cover 23·5 per cent.; the remaining 35·5 per cent. was occupied by no fewer than 26 other varieties. The average cash return for the whole of the recorded wheat crops was £10 12s. 9d. per acre. It is manifest that many farmers could improve their results by changing their variety. Quality, however, in the sense of suitability for bread-making, remains an unimportant factor; the yields were slightly higher in 1928

Variety	Fields	Area	Average yield per acre			Av. price per qr. head- corn	Av. cash return per acre		
			Head- corn	Seconds	Total				
Victor ..	47	Acres 636·25	Qr. 4·79	Qr. ·36	Qr. 5·15	s. d. 43 9	£ s. d. 11 2 11		
Yeoman and Yeoman II (combined)	52	751·50	4·72	·33	5·05	44 5	11 1 11		
Little Joss ..	31	412·50	4·07	·25	4·32	44 7	9 10 8		
Squarehead's Master ..	32	384·75	4·03	·25	4·28	44 9	9 9 7		

than in 1927 and the grain looked better, but the general level of prices fell and the average cash return was consequently 10s. 10d. per acre lower in 1928.

Few Essex farmers seem to grow spring wheats and such returns as there are show how much more successful autumn sowing is.

Winter Barley.—The hard winter reduced the number of returns from autumn-sown barley crops. The Plumage-Archers in 1928 represented 89 per cent. of the recorded area ; only four other varieties are mentioned in the returns. Not only was Plumage-Archer more profitable to grow than the others, but as an autumn-sown crop it yielded nearly £3 per acre more than when sown in the spring. Too few fields of Spratt-Archer were recorded, either in 1927 or in 1928, to warrant any comparison between it and Plumage-Archer.

Variety	Fields	Area	Average yield per acre			Av. price per qr. head-corn	Av. cash return per acre
			Head-corn	Seconds	Total		
		Acres	Qr.	Qr.	Qr.	s. d.	£ s. d.
Plumage-Archer and Plumage-Archer, 1924	39	492.5	5.25	.30	5.55	53 10	14 12 3

Spring Barley.—The Plumage-Archers and Spratt-Archer between them occupy 89 per cent. of the spring barley area recorded ; five other varieties and an unnamed group account for the remaining 11 per cent. In choosing varieties of malting barley farmers need to pay as much attention to quality as to yield. It is clear that the merits of Plumage-Archer and

Variety	Fields	Area	Average yield per acre			Av. Price per qr. head-corn	Av. cash return per acre
			Head-corn	Seconds	Total		
		Acres	Qr.	Qr.	Qr.	s. d.	£ s. d.
Plumage-Archer and Plumage-Archer, 1924	106	1482.75	4.96	.32	5.28	45 3	11 14 8
Spratt-Archer	34	437.75	4.83	.37	5.20	45 0	11 9 2

Spratt-Aroher in both these respects are deservedly well known in Essex. The unnamed group, on the other hand, brought in some £2 per acre less than the other varieties—eloquent evidence of the importance of knowing what to grow.

Winter Oats.—Almost the whole of the winter and spring oat crops was fed on the farms, and therefore no prices are given here.

Variety	Fields	Area	Average yield per acre		
			Headcorn	Seconds	Total
		Acres	Qr.	Qr.	Qr.
Grey Winter ..	35	424.2	6.06	.45	6.51
Black Winter ..	17	197.5	5.98	.44	6.42
Marvellous ..	5	53	5.87	.43	6.30

The cold winter took even more severe toll of the autumn-sown oats than of the barleys. Grey Winter, the hardiest variety, gave the best yield and occupied 59 per cent. of the recorded area; Black Winter occupied 27.5 per cent.; six other varieties made up the remaining 13.5 per cent. The inability of Marvellous to withstand frost is illustrated by a reduction in both yield and area as compared with 1926-27. The returns emphasize the need for a new winter oat which will combine with the merits of Grey Winter strength of straw and white grain.

Spring Oats.—Victory and Abundance, two of the best varieties, between them account for only one half the recorded area in both years. Sixteen other varieties were grown in 1927 and 11 others in 1928. Of the latter, Marvellous, well adapted for early spring sowing, yielded excellently. Black Tartarian gave the lowest yield of all. This inquiry, taken in conjunction with the results of the N.I.A.B. trials, seems to suggest that the average yield of oats in Essex could be increased if the best varieties were grown on a larger scale.

Variety	Fields	Area	Average yield per acre		
			Headcorn	Seconds	Total
		Acres	Qr.	Qr.	Qr.
Abundance ..	23	259.75	7.22	.43	7.65
Victory ..	..	142.75	7.11	.43	7.54

General Conclusions.—These returns come in the main from land that is in a good state of cultivation; average yields

ascertained on the same method for the whole county would probably be rather lower than those given above. The number of varieties at present grown is almost certainly too large, particularly in the case of winter wheat and spring oats. A wider use of the varieties which are already widely recognized as the best would probably increase the average yields of the county. It is also clear from these records that early sowing is important, and that if more of the spring cereals could be sown before the middle of March or preferably in February, more farmers would reap good crops. The light and medium lands have given the best returns, but whether there is in Essex differential response of varieties to soil conditions as opposed to the degree of fertility is a question which can only be settled by further investigation. It may, indeed, be claimed that this pioneer work of the Essex County Farmers' Union illustrates well both the scope that exists for crop improvement work and the contribution that the discovery of the best varieties and the purposes for which they are adapted can make to the alleviation of the arable farmer's lot.

NOTE.—In this article the Quarter is taken as : wheat = 504lb., barley = 448 lb., and oats = 336 lb. Nothing is included in the cash returns per acre for the value of the straw.

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MISCELLANEOUS NOTES

THE general index of prices of agricultural produce in December was 43 per cent. above the level of the base years 1911-13 as compared with 44 per cent. in

The Agricultural the previous month and 40 per cent. a
Index Number year ago. The fall of one point on the month was caused by the decline in the indices for barley, fat cattle, eggs, butter and potatoes. Higher values were realized for fat pigs.

Month	Percentage increase compared with the average of the corresponding month in 1911-13					
	1924	1925	1926	1927	1928	1929
January	60	71	58	49	45	45
February	61	69	53	45	43	44
March	57	66	49	43	45	43
April	53	59	52	43	51	46
May	57	57	50	42	54	44
June	56	53	48	41	53	40
July	53	49	48	42	45	41
August	57	54	49	42	44	52
September	61	55	55	43	44	52
October	66	53	48	40	39	42
November	66	54	48	37	41	44
December	65	54	46	38	40	43

Grain.—The average price of wheat at 9s. 5d. per cwt. was 1d. higher than in November, this being the first time since August last that the average monthly price has shown a rise. The relative index number also was 4 points higher at 28 per cent. above the pre-war level. A further fall was recorded, however, in the values and indices for barley and oats; the former was 7d. per cwt. cheaper at 8s. 10d. per cwt. and 7 per cent. above 1911-13, while oats were 3d. lower at 7s. 2d. per cwt. and only 2 per cent. above the base years.

Live Stock.—Fat cattle and sheep showed an advance in price, as is customary in December, but while in the case of sheep the increase in value was about proportionate to that which occurred in the corresponding period of 1911-13, the rise in fat cattle was less pronounced, and the relative index number was three points lower at 30 per cent. above the base years. Fat pigs sold at about 6d. per 14 lb. stone more than in November, and the indices for both bacon and pork pigs showed an increase to 64 and 77 per cent. respectively above pre-war. Store pigs also were a little dearer, but the index number was unaltered at 108 per cent. over 1911-13. Dairy cattle were about 5s. per head cheaper at 31 per cent. more than in the base period, while store cattle were about 7s. 6d. per head dearer at 17 per cent. Store sheep also showed an advance in price, but as this was proportionately less than in December, 1911-13, the index number fell by three points to 48 per cent. in excess of the pre-war level.

Dairy and Poultry Produce.—Milk and cheese prices were unaltered, and the index numbers remained at 67 and 32 per cent. respectively above pre-war as in November. The average price of butter also was unchanged, but as there was an increase in price in December, 1911-13, the index number is lower by five points at 45 per cent. A fall of 3d. per dozen occurred in egg prices, and at 47 per cent. above pre-war the index was seven points lower on the month but ten points higher than a year ago. Poultry, however, was rather cheaper than is customary at this season, and the index number fell by nine points to 34 per cent. above the base period, as against 45 per cent. a year ago.

Other Commodities.—A further decline occurred in prices of potatoes, and the relative index was eight points lower at 10 per cent. over pre-war, or 35 points below that recorded in December last. Vegetables were cheaper also than in November and on average were 50 per cent. dearer than in December, 1911-13, but at this level the index was still about 20 points

above that a year ago. Apples sold at about 25 per cent. above pre-war as compared with 60 per cent. in December last. Hay prices were unaltered on average, and the index number remained unchanged at 41 per cent. in excess of pre-war. The wool index declined by two points to 39 per cent.

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1927	1928	1929			
	Dec.	Dec.	Sept.	Oct.	Nov.	Dec.
Wheat	34	31	31	27	24	28
Barley	35	24	27	21	11	7
Oats	31	29	17	12	6	2
Fat cattle	16	27	34	31	33	30
Fat sheep	44	50	55	55	53	53
Bacon pigs	20	26	52	50	56	64
Pork pigs	33	36	55	64	70	77
Dairy cows	28	34	35	34	33	31
Store cattle	13	21	16	11	15	17
Store sheep	35	49	63	53	51	48
Store pigs	41	30	83	95	108	108
Eggs	41	37	57	81	54	47
Poultry	37	45	45	45	43	34
Milk	66	71	107	55	67	67
Butter	47	50	52	55	50	45
Cheese	55	79	42	37	32	32
Potatoes	75	45	12	17	18	10
Hay	20	8	42	40	41	41
Wool	50	66	47	42	41	39

* * * * *

THE Ministry will continue during the coming season to test, at the Potato Testing Station of the National Institute of Agricultural Botany at Ormskirk,

Wart Disease Potatoes and Potato Seedlings as to their
Immunity Trials, immunity from or susceptibility to Wart
1930 Disease on the conditions stated below.

The entry form (No. 345 H.D.) obtainable from the Ministry should be filled up and returned to the Potato Testing Station, Ormskirk, Lancs., *with the requisite fees*. Samples must be sent to that Station *as early as possible but in any case not later than March 1*.

Potatoes are accepted *from English, Scottish and Irish growers* for trial under the following conditions :—

(a) Quantity of each stock of Potato to be sent for the first time
—35 seed size tubers.

Quantity of each stock of Potato to be sent for the second and for subsequent years—35 seed size tubers.

(b) Fees on the following scale are payable in respect of each stock of Potato when first entered for immunity trials :—

Less than 5 samples from one grower 10s. per sample.

5 samples or more from one grower 8s. per sample up to 20, and 6s. for each sample in excess of 20.

These fees are not returnable under any circumstances.

(c) The Ministry while taking reasonable precautions to secure satisfactory growth can accept no responsibility for the failure of any variety.

(d) The Ministry will take all reasonable precautions to secure that all the produce of the trial plots is fed to stock after being thoroughly mixed together, except such portions as may be needed for exhibition or scientific purposes authorized by the Ministry. The Ministry, however, reserves the right to send tubers from the produce grown at Ormskirk for testing at the official stations of the Department of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland.

(e) All stocks entered for the trials will be tested both in the laboratory and in the field. When the Ministry is satisfied as a result of the trials that a variety is immune from Wart Disease, it will formally "approve" the variety and will issue an official certificate of immunity. Such certificates will not be issued until the variety has been named and until an assurance has been received from the sender that it has been, or is about to be, introduced into commerce. *When a variety tested under a number or letter has been subsequently named and "approved," a sample of 100 tubers of the variety as named must be sent to Ormskirk for comparison with the tested stock.* No certificate will be issued for any new variety until it has passed at least two consecutive years' tests without contracting the disease and has been declared by the Synonym Committee of the National Institute of Agricultural Botany to be distinct from existing varieties.

Potatoes are accepted *from foreign growers* on the conditions (a) to (d) set out above, but no foreign variety will be formally "approved" and no certificate will be issued until the variety is definitely introduced into commerce in Great Britain.

Trials of Seedlings.—The Ministry desires to encourage the breeding of new varieties of potatoes and in order to provide information for breeders of seedlings it is prepared to accept not fewer than two tubers, and not more than ten tubers, of any seedlings for testing in the laboratory and growing for one season on the trial plots, and to furnish a report on the results obtained, without payment of a fee. These tests, however, will not be considered as forming part of the Immunity Trials proper and will not be reckoned in the minimum period of two years referred to under (e). The results of these tests will not be included in any report issued by the Ministry.

GENERAL INSTRUCTIONS: *Carriage.*—Small consignments should be sent by passenger train, carriage paid, or by parcel post; larger consignments should be forwarded by goods train, carriage paid.

Labels.—All consignments should be distinctly labelled. A label bearing the name and address of the sender and name of variety or seedling number should be firmly tied to the bag; in addition a similar label should be placed inside the bag.

Address.—All consignments should be addressed to:—

THE SUPERINTENDENT,
POTATO TESTING STATION,
NATIONAL INSTITUTE OF AGRICULTURAL BOTANY,
ORMSKIRK, LANCS.

Station: Ormskirk, L.M. & S. Railway.

Date of Forwarding.—Consignments should be sent so as to reach the Testing Station as early as possible and in any case not later than March 1.

* * * * *

National Diploma in Agriculture.—Prospective candidates may now obtain the Regulations and Syllabus for this year's Examination in Agriculture to be held under the auspices of the National Agricultural Examination Board. The Examination takes place at Leeds University on April 8 and following days, and includes the following subjects: *Practical Agriculture (two papers), Farm Machinery and Implements, Land Surveying and Farm Buildings, Agricultural Chemistry, Agricultural Botany, Agricultural Book-keeping, Agricultural Zoology, and Veterinary Science and Hygiene.* The whole nine papers may be taken at one time, or a group of three, four or five in the first year, and the remaining subjects within the next two years.

To be eligible for admission to this examination, candidates must present certificates from a recognized College for the subjects of General Botany, General Chemistry, Geology, Physics and Mechanics; and, before the Practical Agriculture and Farm Machinery Papers are taken, candidates must also produce evidence of having resided on a farm for a complete year of farming operations.

Applications for permission to sit for the N.D.A. Examination must be sent in not later than Thursday, February 20.

Full particulars may be obtained from the Secretary of the Royal Agricultural Society of England, 16 Bedford Square, London, W.C. 1, or the Secretary, Highland and Agricultural Society of Scotland, 3, George IV Bridge, Edinburgh.

* * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on Monday, December 23, 1929, at 7 Whitehall Place, S.W. 1, the Rt. Hon. The Viscount Ullswater, G.C.B., presiding.

The Board considered a notification from the Derbyshire Agricultural Wages Committee of a decision fixing minimum and overtime rates of wages for male and female workers and made an Order carrying the decision into effect as from December 26 (when the existing rates are due to expire). The minimum rate in the case of male workers of 21 years of age and over is 8d. per hour with overtime at 10d. per hour for all Sunday work. In the case of female workers of 18 years of age

and over, the minimum rate is 5d. per hour with overtime at 8d. per hour for all employment on Sunday. These rates will continue in force until December 25, 1930.

Copies of this Order in full may be obtained on application to the Secretary of the Agricultural Wages Board.

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending January 14 legal proceedings were instituted against 13 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages			No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	d.	
Lincoln,											
Lindsey..	Wragby ..	1	10	0	2	10	3	16	16	6	3
Hereford ..	Abbeydore ..	---			Case dismissed			—			2
Somerset ..	Wincanton ..	6	0	0	0	5	0	15	10	2	3
Wilts. ..	Chippenham	2	0	0	—			4	0	4	1
„ ..	Cosham ..	5	0	0	—			12	0	0	1
„ ..	Malmesbury	0	5	0	—			1	12	0	1
„ ..	„ ..	2	0	0	---			8	6	8	1
Worcester ..	Upton-on-										
	Severn..	4	0	0	4	8	0	30	8	0	4
„ ..	Upton-on										
	Severn..	5	0	0	4	16	0	73	2	2	6
Yorks, W.R.	Thorne ..	4	0	0	—			25	12	2	2
„ ..	York Castle	*			0	10	0	18	0	0	1
Cardigan ..	Cardigan ..	1	1	0	—			20	9	8	1
Montgomery	Montgomery	0	2	0	—			52	5	8	1
		£30	18	0	£12	9	3	£278	3	4	27

* Dismissed under Probation of Offenders Act.

In addition to the above, proceedings were taken against an employer at Ross Police Court under Section 9 (3) (d) for giving false information, and a fine of £5 was imposed, with the addition of 15s. costs.

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Foot-and-Mouth Disease.—An outbreak was confirmed on December 23 at Goring-by-Sea, Worthing, West Sussex, and the usual restrictions were applied to an area of approximately 15 miles radius round the infected premises. No further outbreak resulted and the restrictions were withdrawn on January 14. As the restrictions imposed in connexion with the outbreak at Avonbridge, Muiravonside, Stirlingshire—referred to in the January issue of this JOURNAL—had been withdrawn on January 8, the position as this issue goes to press is that as from January 14 no general movement restrictions remain in force in connexion with foot-and-mouth disease in any part of Great Britain.

During the year 1929, 38 outbreaks were confirmed in Great Britain. This is the lowest number of outbreaks in any year since 1918, and compares with 138 outbreaks in 1928, 141 in 1927, and 204 in 1926.

NOTICES OF BOOKS

Theory and Practice in the Use of Fertilizers. By Firman E. Bear, Ph.D. Pp. 348. (London: Chapman & Hall, Ltd.; New York: John Wiley & Sons. 1929. Price, 20s. net.)

The judicious use of fertilizers requires very considerable knowledge, experience, and judgment; for the factors concerned are numerous, complex and usually ill defined. Dr. Bear's book provides a summary of the type of information required. It brings together the various views concerning fertilizer practice and traces their development from the days of Liebig and Lawes to the present time. The treatment is mainly historical and, in a sense, personal, for the portraits of some of the leading figures appear among the illustrations while their views are frequently given in their own words.

The first half of the book contains an account of the great discoveries and stimulating theories which led up to our present knowledge of the soil as a source of plant food. Chapters are devoted to the factors concerned in the gains and losses of nitrogen, and the quantitative changes of the mineral content of the surface layers of the soil. A brief sketch of the development of the fertilizer industry follows, after which the individual manures are considered in regard to their manufacture and in relation to climatic factors, the soil, and the crop.

The chapter on mixed fertilizers, which play so much greater a part in American than in European agriculture, sets out the recent tendencies in this field, namely, the reduction of the number of brands to a few standard ratios of nutrients, and the gradual elimination of low-grade mixtures in favour of higher analyses, with consequent saving of transport costs.

Typical fertilizer practices are set out on the basis of the views of the great English and German experimenters, and also more particularly in the light of the results of the older established experimental plots of the United States.

The Neubauer and Mitscherlich methods are briefly mentioned in relation to the selection of fertilizers, but nothing is said of the value of small plot trials of the type that are now developing so rapidly in the experimental rings of Germany. The application of fertilizers receives a special chapter, and it is in this department that more work has been done in the United States than elsewhere. In dealing with organic matter the author makes it clear that the importance of the process of making artificial farmyard manure, as developed in this country, is becoming realized in his own country. The analysis of this manure, given on page 324, is obviously expressed on the dry matter, although this should perhaps have been stated.

There is much in this book which should appeal to those who, studying fertilizers from the more practical viewpoints, still have an interest in the theory and order of development of their subject. The references which follow each chapter give a key to the more complete information which could not possibly be contained within the limits assigned.

The Journal of the Orkney Agricultural Discussion Society.—Volume IV, 1929. Pp. 87. (Price 1s. 3d., post free, from the Secretary, Agricultural College Office, Kirkwall, Orkney.)

This issue contains articles bearing on problems of agriculture of all kinds, prominent amongst which are questions of marketing. The care of implements, sheep farming, beekeeping, and the rearing and breeding of cattle, as well as some of the social aspects of the life of the farming community, are all discussed.

Progress in English Farming Systems.—I.—Milk Production on Arable Land. By F. J. Prewett, Agricultural Economics Research Institute. Pp. 21. (Oxford: Clarendon Press. 1929. Price, 1s. 6d. net.)

The shrinking of the tillage area in this country, although a large proportion of this area is devoted to the production of fodder and forage crops, has engaged the attention of all agriculturists for many years. This Bulletin is a record of an investigation made into the accounts of a Lincolnshire (Kesteven) farm which differs widely from the usual system of farming in the district. It is devoted to arable, dairy farming, and the management gives its attention solely to the production of corn and milk. The farm has weathered the fluctuations of the post-war years, and is regarded by the investigators, who are responsible for the pamphlet, as a revolutionary reorganization of the farming of the district.

A Text-Book of Tropical Agriculture.—Sir Henry Alford Nicholls, C.M.G., M.D., F.L.S. New edition, revised by John Henry Holland, F.L.S., with a foreword by Arthur W. Hill, C.M.G., etc. Pp. xxxvi + 639. Illustrated. (London: Macmillan & Co., Ltd. 1929. Price 15s. net.)

This is a revised edition. The book was first published in 1892 and was intended to be primarily a textbook for the use of schools and colleges in the West Indies, but the revised edition has been expanded to cover the much wider area of the tropics now developed, and the new crops which have been consequent upon that expansion. It covers in summary form as wide a field as possible in the course of a single book, which must necessarily contain references to crops upon which separate treatises have been written. At the end of each chapter references to further literature are given.

A Tentative List of Tulp Names.—Pp. 80. (Published by the Royal Horticultural Society, Vincent Square, S.W. 1. 1929. Price 1s.)

The success of the Society's scheme for the registration of daffodil names, and the disappointment and loss suffered by horticultural traders and amateur gardeners through confused plant nomenclature, have made it clear that it would be in the interests of all concerned if a given name were, in fact, restricted to one plant only. The Tentative List is a contribution towards that end, and has been compiled in conjunction with the General Bulb Growers' Society of Haarlem.

Agricultural Research in 1928.—Review by the Royal Agricultural Society of England. Pp. 193. (London: John Murray. 1929. Price 1s.)

The format of this annual review of the progress of agricultural research is now becoming familiar: this is the fourth volume to be published. The usual summaries of developments, which have taken place, are provided by authorities eminent in their departments, and it is interesting to note that in some cases readers are warned against the too hasty assumption that a scientific principle, which has been discovered, is capable of immediate general application in practice. The summaries are completed by bibliographies of essays, etc., published during the year.

The Society expresses the hope that the volume will be freely drawn upon by local Advisory Officers and the Press, so that the information it contains may be dispersed as widely as possible amongst the agricultural public.

Your Flower Garden and the Things that Matter.—By Alfred E. Livingston, F.R.H.S. Pp. x+208. Illustrated. (London: Crosby Lockwood & Son. 1929. Price 5s.)

The writer addresses himself largely to the beginner, pointing out that while intelligence and knowledge must be used if a successful flower garden is to be cultivated, the measure of knowledge required can be readily obtained. His little book, which covers the ground comprehensively, does much to make this knowledge readily accessible, and will be of service not only to beginners, but also to those who have experience.

The Crop-grower's Companion. By John Porter, B.Sc., N.D.A., N.D.D. Pp. xxi+447. (London: Gurney & Jackson. 1929. Price 8s. 6d. net.)

This book gives a clear and concise exposition of the principles and practice of crop-growing. The subject has been dealt with before, but seldom perhaps is the essence of agricultural science so attractively presented to the work-a-day farmer, and its application so effectively demonstrated as in this volume. The student, also, will find the book an invaluable "companion"; while stimulating and imaginative, it is always safe and sane.

The author has dipped deeply into the old writers and it will be surprising if readers are not prompted to make still further explorations in that quarter. Part V, for example, contains a short history of pasture-making up to the present day, than which nothing is better calculated to restrain us from "thinking more highly of ourselves than we ought to think." More than 100 years ago, George Sinclair, of Woburn, had discovered the secret of permanent pasture-making by using indigenous seeds and, in collaboration with Humphry Davy, had demonstrated the superiority of leaf over stem. Rotational grazing, as now understood, was adopted by the best pastoralists at least a century ago, and it is stated that a farmer in North Bucks was wont to turn his cows into a fresh pasture every Monday morning. The author's account of the seeding and management of grass land shows that farmers of the old days knew a great deal about grassland treatment, and had adopted methods that are being re-discovered to-day. On this particular aspect, it is doubtful if anything better has ever been written than Parts IV and V of this book. Certainly, no farmer looking to grass as a way out of his present troubles will find a more helpful or trustworthy guide.

The arable farmer, likewise, will find his problems treated in a spirit of sympathy and understanding, and may most usefully read this book. One or two slips will require correction in the next edition; for example, the answer to the problem set on page 407.

Livestock Enterprises.—Edited by Kary C. Davies, Ph.D. Pp. vii+492. Illustrated. (London: J. B. Lippincott Co. 1929. Price 10s. 6d. net.)

Dr. Davies' work is a handbook for teachers engaged in vocational teaching in agriculture. The division of livestock enterprise into seven headings is made as follows: Dairy, Beef, Horse and Mule, Swine, Sheep, Poultry and Bee Enterprise, each section being written by a member of an American University Staff. Material is provided to enable teachers to split up their courses into class lessons which shall have a direct bearing on the practical instruction being given at the same time.

The book is one of a series being issued by the same publishers, and although American conditions are rarely directly parallel to those at home, material will be found here that may prove useful.

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NOTES FOR THE MONTH

THE official list of entries for the World Tractor Trials, which are being held under the auspices of the R.A.S.E. in conjunction with the Institute of Agricultural Engineering, University of Oxford, marks the notable advance made during recent years in the application of power machinery to agriculture. No fewer than thirty-five machines, including entries from the leading manufacturers in the British Isles, America, France and Germany, have been accepted for the trials by the joint organizing bodies. These various machines represent, in their different classes, the latest standard models, embodying all the most recent improvements.

The trials, which are to be held during the summer and autumn of the present year, will be exhaustive, and the published reports, giving full particulars of the various performances under the most searching tests, will enable British agriculturists to decide which machines are best suited to farming conditions in this country. British manufacturers will also be enabled to show how their improved models compare in efficiency with the latest American and Continental types.

Two features of the entries are of especial interest as showing the important advances made by British manufacturers during recent years. Crude oil engines, using a cheap fuel, will, it is anticipated, reduce the working costs of power machinery on the farm, and of the eight entries of this type, no fewer than six come from British firms. Again, in the section devoted to tractor cultivators suitable for use by market gardeners and smallholders, the only machines on trial, three in number, are made by British firms. Much interest will attach to the official reports on these "market garden tractors."

The Trials, which are to be held near Wallingford, will be divided into two parts: (a) extended tests of a scientific and practical nature which will be conducted in private; and (b) public demonstrations, to be held during September, when the machines will be seen in operation under strict working conditions.

THE Annual Report on the work of the Land Division of the Ministry for the year 1928 has recently been published.*

The Report includes, *inter alia*, sections

Report of the dealing with proceedings under the fol-
Land Division lowing Statutes: Small Holdings and

Allotments Acts, 1908 to 1926; Small Holding Colonies Acts, 1916 and 1918, and the Sailors and Soldiers (Gifts for Land Settlement) Act, 1916; Improvement of Land Acts; Universities and College Estates Act, 1925; Glebe Lands Act, 1888; Agricultural Holdings Act, 1923, and the Ministry of Agriculture and Fisheries Act, 1919. Other miscellaneous activities of the Ministry which are reported include those connected with (a) the destruction of rats and mice and other land pests; (b) the issue of certificates as to obtaining possession of agricultural cottages in certain cases; and (c) the destruction of injurious weeds.

The Small Holdings Section of the Report contains an account of the second year's operations under the Small Holdings and Allotments Act, 1926. Full particulars are given of the acquisition of additional land by County Councils for small holdings or cottage holdings, the equipment of existing holdings, and the advance of loans to persons purchasing holdings from private owners. An Appendix to the Report gives a brief description of several estates acquired by Councils under the Act and is illustrated by attractive photographs of some of the houses and buildings erected thereon.

The section of the Report which deals with allotments includes an analysis of the returns received from allotment authorities at the end of 1928. These show a further small decrease in the total number and area of allotments under cultivation in England and Wales, though the area of land owned by allotment authorities has again slightly increased.

The proceedings of the Ministry under the Small Holding Colonies Acts and the Sailors and Soldiers (Gifts for Land Settlement) Act are dealt with in a further section, which contains an account of the administration during the year of the six farm settlements under the control of the Ministry. These include one profit-sharing farm and five small holdings settlements, and the Report includes interesting details of the sub-division of these estates and the increase in the resident population and in the numbers of live stock kept

* Published by H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, price 4s. net, post free 4s. 1d.

since the estates were developed by the Ministry. Accounts for each settlement are also given.

The section on the Improvement of Land Acts deals with applications by landowners, under those Acts, for the issue of Orders charging their estates with the cost of various works of improvement, details of which must be submitted for the approval of the Ministry before the work is executed.

Further sections of the Report cover the redemption and apportionment of rents under the Law of Property Act, 1925, and transactions which came before the Ministry in connexion with the extinguishment of manorial incidents and the conversion of perpetually renewable leases into long terms under the Property Acts, 1922 and 1924.

Particulars are also given of the commons placed under regulation during the year, and of the inclosure for special purposes of portions of commons, carried out with the Minister's approval. This section of the Report also refers to the deeds of declaration which were deposited with the Ministry during the year under the Law of Property Act, 1925, the effect of which was to confer upon the public rights of access to the commons concerned for air and exercise. The total area of commons affected by the deposit of deeds under this section up to the end of 1928 was 8,672 acres.

The Report also gives particulars of the transactions effected under the Universities and College Estates Acts, and reference is made to the fact that universities and colleges borrowed more capital money in 1928 for the application to purposes such as road-making on housing estates, additions and improvements to town and agricultural properties, and repairs to college buildings, than in any previous year.

Another section of the Report gives the number of appointments of arbitrators made and of the orders issued by the Ministry since 1921 under the provisions of the Acts affecting agricultural holdings.

The Report deals also with the constitution of agricultural committees established in accordance with the provisions of the Ministry of Agriculture and Fisheries Act, 1919, and particulars are given of the exercise by the committees of their powers relating to certificates under the Rent Restrictions Acts and the destruction of injurious weeds.

Under the heading of "Miscellaneous Activities" is included a section dealing with the subject of the destruction of rats and mice. In connexion with the National "Rat Week" campaign, organized annually in November by the Ministry,

brief particulars are given of the methods adopted by local rat authorities and others to give publicity to the matter and to make the campaign a success.

* * * * *

THE following announcement has been made in *Landtechnik*, the press service of the German Reichskuratorium für Technik in der Landwirtschaft :—

Transplantation of Cereals

For some years past accounts have appeared in the technical Press, and frequently also in the daily papers, of fantastic increases in yield (some hundreds per cent.) which are stated to result from the transplanting of cereals. The many inquiries received by the Reichskuratorium für Technik in der Landwirtschaft both from industrial and agricultural circles have shown that the statements have not failed to make an impression. Industrialists wanted to know whether they should turn their attention to the problems involved in cereal transplanting machines, while many agriculturists hoped that by cereal transplanting they might, through higher yields, put their affairs on a more satisfactory footing.

The agricultural experts of the Reichskuratorium were sceptical of the results of cereal transplanting. All applications for assistance in the development of transplanting machines were accordingly refused. In order, however, thoroughly to test the constantly repeated claims that were being made for the method, the Reichskuratorium decided at the beginning of 1929 to obtain records of the numerous transplanting experiments actually in progress in Germany.

It was possible to arrange for observations to be made in respect of 146 experiments in all. The spacing of the plants varied from 20 by 20 to 35 by 35 cm. Tillering was in all cases extraordinarily good. As compared with the drilled plots the harvest was delayed by from 8 to 14 days. As a result the transplanted plots suffered from the dry period, and it is not impossible that the yields were unfavourably affected thereby. Wherever possible the harvesting of the experimental plots was carried out in the presence of Diplomlandwirt Weiss, a representative of the Reichskuratorium. The samples were sealed up and were later thrashed out in experimental plot thrashing machines. The results were not favourable. Of the 146 experiments, only 32·4 per cent. showed a higher yield in the transplanted plots compared with the drilled plots, while 67·6 per cent. showed a lower yield. The yield increases were

between 0 and 69·2 per cent. Of the experiments in which increased yields were recorded in the case of the transplanted plots, 45·8 per cent. showed increases of more than 30 per cent. and 54·2 per cent. showed increases of less than 30 per cent. In no case did the increase amount to as much as 100 per cent.

Notwithstanding the unfavourable results thus obtained, the investigation should not be brought to an end, since yield increases of some 50 per cent. were recorded in a number of properly controlled experiments under normal conditions, and it is desirable that the conditions of growth under which these yield increases occurred should be determined. At the request of the Reichskuratorium, the experiments will be continued by the Landwirtschaftliche Hochschule, Berlin (the Berlin Agricultural College).

The results of the investigations up to date indicate that the value of the transplanting of cereals must be regarded as negative, as far as practical agriculture is concerned.

* * * * *

THE Fourth World Poultry Congress to be held at the Crystal Palace in July next has succeeded in attracting the attention and support of 50 countries,

The World Poultry Congress and, at the time of writing, more than a score of national exhibits have been promised. There could be no better testimony to world-wide interest in the poultry industry. All space allotted to trade exhibitors in the Centre Transept has been filled, and applicants whose decisions were made too late to secure a position there are finding a place in the rapidly diminishing area of the galleries. Flock owners from overseas have, in some cases, doubled the number of birds they first proposed to send, and there is no doubt that there will be a very heavy representation of the poultry and small livestock of all the world, ranging from neighbouring countries across the Channel and North Sea, to such far-off lands as Java, the original home of the Indian Runner Duck. In these circumstances, it would be well for British poultry keepers to take prompt measures to ensure representation, for the space is limited and the time is short.

Widespread interest is being shown in the British National Exhibit, and the organizers are endeavouring to make an effective pictorial display of the progress of the poultry industry in this country. They hope to pay adequate tribute to the work of the County Authorities, work which all con-

cerned with the welfare of the industry acknowledge to be of high value. Local Authorities have made generous contribution to the cost of the Exhibit, and the Ministry has selected a nominated body of Instructors to give full effect to the endeavour. Mr. Claude Taylor, of the Department of Overseas Trade, who is largely responsible for the effective exhibits of the Empire Marketing Board, is giving his assistance to the work in hand and the result of joint endeavour is likely to give satisfaction to all concerned.

On the educational side of the World Congress the work is complete, nearly 160 papers having been selected to be read at the five daily sessions which will be held in five centres from 10 a.m. to 1 p.m. every day. On the social side final arrangements have been made. The Services and the B.B.C. will lend their aid to the musical and entertainment items of a programme which will be of outstanding excellence, while of receptions and entertainments there will be no end.

The Canadian Government is installing at the Crystal Palace, in a prominent position, a model of the Prince of Wales' ranch, a model 100 ft. by 50 ft. representing about 75 acres of the total ranch and including the Homestead. It is also sending over the famous Ottawa Temple Choir, which will sing at the Crystal Palace during the week of the Congress and will tour the country afterwards.

Delegates are already booking for the Post-Congress Tour which is to cover the beauty spots of England and Scotland, Ireland and Wales, while taking visitors through the centres of the poultry industry. Particulars have been set out in an illustrated booklet which will be sent free of charge on application to the Congress Secretary, 10 Whitehall Place, London, S.W. 1.

* * * * *

In order to encourage and assist the production and marketing of genuine home-produced wild white clover seed, arrangements have been made by

Inspection and Certification of Wild White Clover	the National Farmers' Union, in co-operation with the Ministry of Agriculture and Fisheries, to organize a scheme for the inspection and certification of crops of this seed.
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A Central Wild White Clover Committee has been set up at the headquarters of the National Farmers' Union, 45 Bedford Square, W.C. 1, and local committees are being formed in each county area where wild white clover seed is produced.

Growers, including non-members as well as members of the National Farmers' Union, who wish to have their crops inspected and certified should obtain a copy of the form of "Application for Field Inspection" (Reference W.W.2) from the Secretary of their county committee, whose address is care of the County Branch of the National Farmers' Union, or directly from the Secretary of the Central Wild White Clover Committee, 45 Bedford Square, W.C. 1. This form should be completed and returned to the County Committee by whom it will be endorsed and forwarded to the Ministry of Agriculture and Fisheries, through the Central Committee, with a recommendation that the proposed inspection should be made.

Applications for field inspection cannot be accepted by the county committee after April 15 of the year in which the inspection is to be made.

The Ministry will then arrange for the inspection of the crops so recommended and, upon this inspection proving satisfactory, each field will be registered by the Central Committee as an "approved field" and the grower as an "approved grower."

At the time of the inspection a representative sample of seed heads will be taken for a growing-on test to be conducted by the Ministry. The results of these growing-on tests will be communicated to the grower as soon as they are available, which will not be until the early part of the season following that in which the fields are inspected.

When the grower has harvested and has cleaned the produce of one or more of his "approved fields" he will be supplied on application being made on a special form (Reference W.W.4)—copies of which will be supplied by the County Committee—with an official certificate issued by the Ministry and countersigned by the Central Wild White Clover Committee. This certificate will bear a reference number which may be quoted in connexion with sales of seed which is the produce of the crop certified.

In practice it is anticipated that growers submitting to the scheme will endeavour to secure that all the fields from which they hope to obtain crops of wild white clover seed from time to time will be inspected at the outset. They will then have complied with the preliminary requirements of the scheme, and be in a position to apply for certificates for such of these crops as they decide to harvest for seed from year to year.

The certificates issued by the Ministry will be in respect of two grades of seed. The "Grade A" certificate will relate to

crops of genuine old pastures, i.e., those which have been under grass for ten years or more, and the "Grade B" certificate will refer to crops of once-grown indigenous wild white clover, i.e., once-grown from seed from genuine old pastures.

Type samples (drawn by the grower or his agent) of the seed of every certified crop must be deposited at the Official Seed Testing Station at Cambridge, and any purchaser of seed sold under a certificate number will be entitled to send a sample to that Station for a growing-on test at a nominal fee.

The only charge that will be incurred by the grower submitting to this scheme will be that required to cover the cost of the field inspection by the Ministry. This fee, which will be required to be paid at the time the inspection is carried out, will be at the rate of 2s. 6d. an acre for the inspection of crops up to 8 acres in extent, £1 1s. 0d. for crops exceeding 8 acres and taking up to four hours to inspect and £2 2s. 0d. a day for crops taking more than four hours to inspect.

The inspection of pastures and crops will be started in 1930 and growers are advised to lodge their applications for field inspection with their county committees at the earliest possible date.

* * * * *

IN May, 1929, a Conference of Rural Women's Organizations, called together on an experimental basis by the International Council of Women, was held in London under the chairmanship of the Marchioness of Aberdeen and Temair.

Conference of Rural Women's Organizations

The Conference was largely attended and produced an interesting interchange of information as to the achievements and aims of rural women's organizations in many parts of the world. The success of this initial meeting led to the setting up of a liaison Committee of Rural Women's Organizations, charged with the work of compiling a report of this Conference, and of endeavouring to promote a further conference, to be held in Vienna in May, 1930, in connexion with the quinquennial meeting of the International Council of Women.

The Committee has now issued, under the title of "What the Countrywomen of the World are Doing," an attractive little volume summarizing the proceedings of the 1929 conference. This should prove an invaluable book of reference for all who are interested in the work of countrywomen, for it presents, in handy form, the reports which delegates made on the work of those organizations in their own countries which most

closely correspond to our own Women's Institutes. The book is, therefore, full of facts and suggestions, and should be an inspiration to future effort in many fields of endeavour. It is obtainable (price, 1s. 6d.) at the office of the International Council of Women (117 Victoria Street, London, S.W. 1) and should be of service to all who are concerned with the betterment of country life and the cultivation of better international relations.

The Committee have arranged a conference, to be held in Vienna at the end of May next, and the prospect of this meeting has already evoked considerable interest.

* * * * *

A REPORT on the occurrence of fungus, bacterial and allied diseases of crops in England and Wales for the years 1925-27*

has recently been published by the
Report on Fungus Ministry, in continuation of the series
Diseases of Crops, which commenced in 1917. In the previous
1925-27 report various hosts and the diseases

that attack them were set out in very
considerable detail in order to form, as far as possible, a
host-disease list covering agricultural and horticultural crops
of this country which might serve its purpose for several years
to come. In the present report an attempt has been made to
cover the ground in a more limited space. A few diseases are
mentioned in the new report that have not appeared in previous
ones ; this, however, is not necessarily because they are new,
but because the hosts concerned have not previously been
included under the caption of "agricultural and horticultural
crops." On the other hand, during the period covered, several
parasitic fungi believed not to have been recorded previously
in this country, and two entirely new ones, have been en-
countered. Amongst other points of special interest may be
mentioned the following : The Downy Mildew of the Grape
Vine made its second appearance here after an interval of
32 years, in 1926, on a single outdoor vine in Kent. The Downy
Mildew of the Hop, which was first noted in England in 1920,
has become established not only here but also in several
countries on the Continent within the last few years. The
attack of rhododendrons by *Stereum purpureum* Pers., the
fungus that causes "silvering" of the foliage of most of its
hosts but not of this one, is of considerable interest.

*Miscellaneous Publications No. 70, obtainable from the Ministry,
price 3s. 6d. net, post free.

As is well known, weather conditions have a great deal to do with the causation and intensity of plant disease ; and, although in the British Isles the vagaries of the weather are so considerable that close correlation of the factors with outbreaks of disease is almost impossible, yet certain broad inter-connexions can be recognized, and an endeavour is made to trace these in the present report.

As to the control of plant diseases during the three-year period, the most important event from the administrative point of view was the passing of the Destructive Insects and Pests Act, 1927, amending the two previous acts of 1907 and 1887, respectively. The new Act defines the expression "insect" more comprehensively than was formerly done, and it now includes "bacteria and other vegetable or animal organisms and any agent causative of a transmissible crop disease." In one or two other important directions, also, the Act strengthens the hands of the Ministry and will enable it to deal more promptly and effectively than formerly with outbreaks of new diseases or visitations of foreign pests.

Of the six diseases scheduled under the D.I.P. Act, three have as yet made no appearance in the country. These are "Fire Blight," Black Knot, and Chestnut Canker. Our knowledge of ways and means of combating plant diseases has steadily advanced during the three years, and we are becoming much less dependent than formerly upon the assistance of work done in foreign countries. The report makes reference to the outstanding instances of such work and should prove of great value to students and writers on the subject, as well as to the agricultural and botanical departments of colleges and research institutes.

* * * * *

DURING the past few years, the Library of the Ministry has been increasingly used by all kinds of people interested in agriculture and agricultural questions.

Early Agricultural Books The number and value of the books housed in the Library has, however, not yet been fully realized by those to whom it might be useful. Attention may again be drawn to the fact that the Library is open to the public for the purpose of consulting books during the hours when the Office is open.

From many points of view, one of the most interesting sections of the Ministry's Library is the collection of early agricultural books, some few of which date from the seventeenth century. Although it cannot be claimed that these books form

anything like a complete collection of historical sources, yet access to them should be most valuable to students and others who are interested in the history of agriculture and its allied social subjects.

With the object of indicating the facilities for research in the Ministry's Library, and available to any accredited student, a *Chronological List of Early Agricultural Works in the Library of the Ministry* has been compiled by Mr. G. E. Fussell and published by H.M. Stationery Office. It can be obtained through any bookseller or direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. (Price 2s. net.)

It should be added that the list includes that part of the Cowan Memorial Library published before 1830, for although that Library is primarily concerned with bees, it contains many works on general agriculture, which include sections dealing with apiculture.

* * * * *

THE following note has been communicated by Mr. A. W. Ling, M.Sc., N.D.A., Dip.Agric., of the University of Bristol.

The Sugar Investigations into the lifting of sugar
Content of Beet beet* were carried out by the writer and
his colleague, Mr. W. R. Muir, in order
to ascertain whether there was an increase

in the sugar content of sugar beet if, after the roots were lifted, they were left in the field untopped for a few days before topping and carting to the factory.

For the purpose of the experiment five representative samples of beet were lifted in October, 1929, topped and taken to the laboratory for analysis on the same day. At the same time five samples were lifted and knocked together to remove adhering soil; these were left lying in rows untopped for a week, when they were analysed. A third batch was loosely ploughed out, but not pulled out or topped, and left in contact with the soil for a week and then analysed.

From the data obtained, the following tentative observations are made :—

- (1) There is a definite increase in the dry matter and sugar content of beet as the result of leaving them untopped in the field for a week after pulling or ploughing out.
- (2) There is a levelling up of the sugar content of the beet when they are pulled out of the soil and left in the field for a week before carting and analysing.

* The Investigations are fully described in an article appearing in *The International Sugar Journal*, 1930, Vol. 32, pp. 19-20, from which this abstract is printed by kind permission of the publishers.

- (3) The percentage of sugar in the dry matter remains more or less constant under the three methods of treatment described above.

While it would be unsafe to draw definite conclusions from one season's work, it would appear that under favourable climatic conditions sugar beet that are pulled and left in the field untopped for a few days, before carting and analysing, lose moisture, resulting in an increase in the dry matter content. This is reflected in a higher sugar content, but the weight of sugar per acre seems to remain about the same. The actual weight of material to be carted and handled would therefore be somewhat less. It is doubtful, however, whether the procedure is justified, on account of the additional handling of the beet when they have to be pulled and left on the ground and then again handled at a later date for the purpose of topping and carting.

The author's thanks are due to Mr. J. Pope, of Rye Hill, Warminster, and Mr. W. T. Price, Agricultural Organizer for Wiltshire, for their assistance and co-operation in this preliminary investigation, which it is hoped to continue at a future date.

* * * * *

THE Agricultural History Society was formed in the United States in 1927, and is being developed as a medium for the publication of researches and documents

Agricultural History Society relating to the history of Agriculture, and as a clearing house for information of interest and value to workers in this field. The term "Agricultural History" is interpreted broadly, material being included on the history of agriculture not only in the United States, but in all countries and at all periods, and also information on institutions, organizations, and sciences which have been factors in agricultural work. The Society has two regular publications, *Agricultural History Society Papers* and *Agricultural History*. The first, consisting of papers read at meetings of the Society, is published in co-operation with the American Historical Association. *Agricultural History* is a quarterly publication, separate issues of which are sold at \$1, or a year's issues for an annual subscription to the Society of \$2. The Society would be glad to extend its membership to Great Britain, and subscriptions or orders for this quarterly should be addressed to Dr. O. C. Stine, Secretary and Treasurer, Agricultural History Society, Room 301, 1358, B. Street, S.W., Washington, D.C. Some

of the essays which have appeared in past issues, and give some idea of the wide range of subject, are: "Egyptian Agricultural Labour under Ptolemy Philadelphus," by W. L. Westermann; "Plant Pathology: A Review of the Science in the United States," by B. T. Galloway; "Ancient Mediterranean Agriculture," by Ellen C. Semple; "The Continental Congress and Agricultural Supplies," by Edmund C. Burnett; and "Jared Eliot—Minister, Physician and Farmer," by Rodney H. True. It is believed that the Society is the only one of its kind in the world, and its activities in this chosen field are so comprehensive that it appeals for widespread and international support.

* * * * *

A YOUNG man, the son of a business man in the Midlands, spent 2½ years attending the diploma courses in agriculture and dairying at one of the agricultural colleges. He obtained the N.D.A. and N.D.D., and subsequently spent a short period on the farm of a well-known pig breeder. In 1928, he took a farm in Warwickshire and went in extensively for pigs. Low prices for pigs reared made his task difficult, but he has stated that his college training enabled him to adjust his feeding and management to advantage.

A Striking Success

At a large fat stock show in December last, this newly established farmer entered three pens in the live classes and three carcass pigs—all as commercial pigs, none in any pure-bred class. For live pigs he was awarded a 50 guinea Challenge Cup for the best pair of bacon pigs in the show, and Very Highly Commended for the heavy weight fat pigs.

His three carcass pigs brought him the following:—

Premier award for bacon pig under 250 lb. live weight.

Premier award for cutter ,, 200 ,, ,, ,,

Premier award for porker ,, 150 ,, ,, ,,

This success of one exhibitor is believed to be a record performance for that particular fat stock show, and is especially gratifying in the case of a young farmer so recently at college.

In each case (both live and dead) the pigs were of the Large White-Middle White cross, in respect of which the exhibitor states: "It is a great benefit, should the pork market be down, to be able to run them on and to know that ultimately the cutter or baconer produced will be first grade."

In a letter to the Principal of his old College, the successful exhibitor states: "I feel it is an honour for me to be able to say that I am a former student of the College. I realize

now, and more so every day, the benefits which I received. It stood me in good stead in every way during the bad time last year ; in fact, I believe it practically paid in one year the cost of my 2½ years' training." Though still a young man, he has been appointed to the Executive Committee of his County branch of the National Farmers' Union.

* * * * *

THE Report on Malt Products made by the Standing Committee set up by the Minister of Agriculture and Fisheries, the Secretary of State for the Home Department and the Secretary of State for
Merchandise Scotland, acting jointly, has now been
Marks Act, 1926 presented.

Copies of the Report can be purchased from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2 ; 120 George Street, Edinburgh ; York Street, Manchester ; 1 St. Andrew's Crescent, Cardiff ; or through any bookseller.

* * * * *

AN Interim Report of the Pig Industry Council will be found at p. 1194 of this issue. It recounts the general activities of the Council since it was constituted in 1928, and contains a statement of its more important findings in the fields of production and marketing. It will be observed from the Report that the Council is of opinion that direct assistance from the State would probably be necessary, in some form, to secure an immediate expansion of the pig industry. In issuing the Report, the Minister cannot be held to endorse any suggestions therein involving direct Government assistance, whether in the form of subsidies or of prohibition or restriction of the importation of articles of food. This would be contrary to the general policy of the Government. The whole Report will, however, receive the most careful consideration. An expression of the Minister's appreciation of the Council's work has already been conveyed, through the Chairman, to the Council, who have been asked to be good enough to continue with the task of exploring and assessing the economies which the industry can itself secure ; of recommending such action by the industry as will, in fact, secure these economies ; of investigating the economic environment of competing bacon industries abroad ; and generally of pointing the way to a higher, all-round standard of efficiency at home.

OPEN-AIR MILKING NEAR GUILDFORD

JOHN PETRIE, C.D.A., N.D.A.,

Manager to Mr. P. A. Molteno, M.A., LL.M.

OPEN-AIR milking is probably not sufficiently advanced in this country to justify anyone attempting a definite decision on the benefits, or otherwise, of machine milking out of doors all the year round. The present article is confined, therefore, to a consideration of some of the advantages and difficulties of the system which have come to light in practice. Having completed a full year's supervision of two milking units under this system, encountering the rather abnormal weather conditions prevailing in the southern counties during that period, the writer may be able to save other beginners from mistakes discoverable only—and sometimes expensively—by experience.

It is presumed that most readers have seen one of the various milking outfits, supplied by most of the dairy supply firms, and shown at the leading agricultural shows during the past few seasons. For the benefit, however, of those who have not, a brief description of the outfit used in this case, and the method of working, is given.

The Milking Outfit.—The particular milker used is composed of two sections, a six-stall “bail” or portable milking place, fitted with a three-unit milking machine, of the “releaser” type, which conveys the milk, by suction, right from the milking units, via an overhead milk pipe-line, to the “releaser valve” over the churn at the end of the “bail.”

This release valve is actuated by the pulsator action, which is mechanically propelled by an independent shafting running along the roof of the “bail” above the cows' hindquarters. In the later patterns, the pulsation is of a different type; and the milk is cooled by refrigeration before it enters the churn. In the present case, the milk is cooled over an ordinary water radiator after reaching the dairy.

The second section consists of the portable power house, fitted with a 3-h.p. Petter internal combustion engine, which is used to drive the vacuum pump, the pulsator shaft, and to generate electric light for the “bail” and power house.

The vacuum pump is connected up with the machine in the “bail” by means of a length of strong rubber piping of the requisite diameter, which is easily detachable, and also of sufficient flexibility to allow for differences of level in the two sections.

The cows are driven into an enclosure surrounded on three sides by cleft chestnut fencing, part of the fourth side being

formed by the milking "bail" and power house, the enclosure being of such a form that the fence does not require lifting every time the outfit is changed to clean ground. The "bail" is fitted with a concentrate hopper between each two cows, the movable bottom of the hopper being operated by handles extending back to the hindquarters of the cows, so that the cake, fed according to requirements, falls into a manger. The manger, which is fitted with hinges, is pulled up out of the way by the same steel cable which, actuated by the attendant behind the cow, raises the galvanized iron door in front of her, through which she passes out to pasture after being milked. The cows, with very few exceptions, are keen to get to their milking places and, except when flies are troublesome in summer, seldom give much trouble during milking. The "bail" accommodates six cows, three with the milking units in work, and three being stripped.

The work is usually done by a man and a boy, the man to look after the milking outfit in general, and the boy to strip the cows after the milk unit is removed. After very little experience, it was found, however, that a boy, stripping at high pressure all the time, did not detect udder troubles, if any were present, so that it has been found better to employ two men to each outfit. The milking can be done at the rate of about 30 cows per hour, 60 cows being a full time quota for each outfit.

The weight of an outfit is just over three tons, and it has to be moved to clean ground by tractor or horses as often as the state of the soil underfoot requires. On thick, sour turf, three to four days would be a reasonable time in dry weather, while on newly-laid-down grass, during a wet season, a change would need to be made every day.

A portable copper is provided for the cleansing of the machine in the field, where it is essential that water shall be readily available. In the present instance, water is laid on to each field, with a stand pipe at the side of the trough to furnish the clean water required for washing purposes. The first cowman looks after his herd generally and cleans his outfit, while the second cowman cools and dispatches the milk, and is responsible for the cleanliness of the dairy.

Concentrates are best supplied in the form of dairy nuts, or a mixture of crushed cakes, as bigger cubes often cause choking of the hopper outlet to the manger. Meals or grains may waste largely through wind owing to the shape of the hopper, while mashes are out of the question because of the

trouble of filling the hoppers, risk of souring and the difficulty of cleaning wooden feeding places.

The Herd.—Beginners may be inclined to regard hardiness as the first quality when purchasing their cows, milk production coming as a secondary consideration; but, in the writer's opinion, no anxiety should be felt regarding their ability to stand harsh conditions, providing the system is started before severe weather sets in.

Irish dairy heifers were purchased for hardiness with a fair promise of milk, but it was found that mature cows of mixed blood, which had been previously housed in winter, not only took readily to mechanical milking but maintained their milk yield, and came out of the hard winter in better condition than the Irish heifers. In practice, it would seem desirable to run a breeding herd, as the wastage of cow stock, owing to their exceptionally good health, is very low. In the event of the resources of the farm being fully utilized by the herd, the calves can be sold as keepers when a week old, and replacements in the cow stock obtained from outside sources.

It may be thought that, by running a bull with the herd all the year round, winter calvings would be a source of trouble. This is not found to be the case, providing care is taken to keep the cows out of valleys where hoar frost is dense. If this precaution is taken, little trouble will be experienced in letting the cows calve in the open, the calf running with its dam until marketed, and the cow being stripped out daily after the calf has had its fill. With over 20 calvings during the harsh winter of 1928-29, only one calf was lost, this being chilled by falling into water before being steady on its feet.

In the writer's experience, good average cows of Dairy Shorthorn or Red Poll breed are hardy enough to calve down in the open air without bad results during an exceptionally cold winter like that of 1928-29. With 125 to 130 cows out-wintered and milked during that season, there were only two cases of illness, one of post-partum paralysis and one of pleuropneumonia. One point to be emphasized is that a fairly high-yielding cow of the so-called dual-purpose type would seem to suit the system best, as in order to keep the cows in condition, a very high maintenance ration is needed during winter; this, for a cow yielding less than two gallons, may amount to as much as 5-6 lb. of cake per gallon of milk, in addition to a very liberal allowance of good hay and roots. The higher the average yield, therefore, the lower will be the

cost of production per gallon as represented by cost of cake and cost of labour for farm-produced foods.

This is a point to be kept particularly in view on an all-grass farm, on which the hay for winter will be largely a catch crop during the rapid growth of pastures in the early part of the grazing season. The fewer head, therefore, that must be carried for the production of a definite quantity of milk, the greater the area that can be closed for winter keep. It is a mistake to shut up so much for this purpose that, during the dry period before the hay crop is off the ground, it is difficult to get a change of pasture for the cows; for no matter how bare and burnt up may appear the pasture to which they are changed, the change is generally followed by a rise in the yield. This is very noticeable during winter, for although a very liberal ration of hay and roots may be fed, a change to fresh—but usually despised—winter pasture generally results in a distinct rise in yield. A change of winter run should not, therefore, be sacrificed for an extra hay rick.

The writer has found it more economical when first stocking to do so with springing heifers, as if some of them turn out poorly they can be sold in the fat market at very little below the usual price of prime meat.

The Pasture.—The open-air system seems particularly suited to the conditions where it was first tried—on downs with large open spaces and few gates. The trampling of the cows during concentration for milking penetrates the sour turf, letting in air to sweeten and fertilize the soil; the cows can seek fresh pasture without moving through a 10 ft. gate going to and from the milking “bail.” Thus, the appalling puddle, about an acre in extent, which is formed round a gateway in wet weather is avoided. Such puddles not only destroy the herbage, but render heavy soils sterile, are dangerous to in-calf cows and make feeding of farm foods difficult and dirty. Beginners would do well to divide their land into parcels of about 60 to 100 acres, according to carrying capacity, and to pull up all interior fences, so that not only can the cows move about freely, but the “bail” has not to be moved through gates, with risk of breakages to both gate and “bail.”

The system is hardly likely to be seen at its best on grass farms of restricted area with small enclosures, for it takes a considerable time, especially if the holding is of a belt shape, to get all the cows through numerous gates for a change of feed. Where it has to be done, a considerable part of the

milkers' time is taken up, which, on the downland farms previously mentioned, is left free for their other duties. The concentration, too, of a large number of cows in these small enclosures means the accumulation of a large amount of farmyard manure, especially during the winter hand-feeding period; and even if this manure is harrowed and utilized by the soil, a type of herbage is produced which is not readily grazed.

On light gravelly soils, the root-hold of the finer permanent grasses is readily disturbed by trampling during the extreme poaching which occurs on these light soils in wet weather; and, on heavy soils, puddling occurs, which leads to uprooting of the herbage and partial soil sterility.

In favour of the system, it may be argued that the soil receives 100 per cent. of the manurial residues of the foods consumed, and that it does away with the costly and laborious transport of farmyard manure; but, while this may be true, the manure lies where it is deposited, not where it may be needed. It is also deposited in a patchy fashion at the best, causing unpalatable pasture for various lengths of time according to the soil and the amount of manure deposited. It seems probable that there is a future for the system on a light soil, or loamy arable farm, with a rotation modified to suit the system.

It is generally admitted that the quick-growing annual or temporary grasses and clovers are as nutritious as the herbage of permanent pastures—perhaps more so, supply a greater weight of feed per acre, and have the power of recuperating more quickly after close grazing. It would appear, therefore, that if temporary mixtures were used for grazing, not only would the acreage needed per cow be less, but the hay crop would be heavier and more nutritious; while the manure could be ploughed in to grow a marketable crop, such as potatoes or wheat, and the fouling effect removed before the land is again used for grazing.

The manurial effects on the very poorest pastures are very striking; the turf is more finely broken up than can be accomplished by mechanical means, and the direct application of potash and nitrogen is demonstrated in the vigorous growth of clovers and grasses. The application of ground mineral phosphates or basic slag at suitable intervals supplies the lime and phosphate, and provides a thoroughly balanced fertilizer very cheaply; and, in the case of an arable farm, would

considerably lower the cost of production of marketable crops.

On poor, gravelly soils, which are not really suited to temporary or permanent grassland farming, as they become dried up badly even in a moderate summer, it would seem that the growing of pulse or cereal mixtures for folding would be practicable, and the fencing, even in dry summers, should be easily erected in light arable soil. Indeed, as it is impossible to harm these soils by trampling, the carting of green crops and roots might be saved if the crop were folded and the cows run on pasture to rest.

In view of the high maintenance requirements of the animals under the open-air system, it may well be asked where the economy of production comes in. This is to be looked for in the low labour requirement and the good health of the herd. During May, 1929, two men could do all the work for the production of 110 to 120 gallons per day, with dead losses in the herd at $2\frac{1}{2}$ per cent., and the young cow stock appreciating considerably. Calves are well started on their dams before sale, are much sought after as being "good doers," and realize good prices. Ordinary care in the cleaning of the machine gives a milk with splendid keeping qualities, consistently above the certified standard, while bacterial counts as low as 1,700 can be got without steam sterilization.

A summary of the factors essential to success would seem to be :—

- (a) A dual purpose herd with a high average yield.
- (b) Well-drained soil on downland pasture.
- (c) Sandy or gravelly soil under a system of alternate husbandry.

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IMPERIAL BUREAU OF ANIMAL GENETICS*

PROFESSOR F. A. E. CREW, M.D., D.Sc., Ph.D.,
*Director of the Imperial Bureau of Animal Genetics and of the
Animal Breeding Research Department, University of Edinburgh.*

THE general scheme of the eight Imperial Agricultural Bureaux has already been adequately described by Mr. W. R. Black in the August (1929) number of this JOURNAL, and I can therefore go straight to the heart of our own work, with one preliminary explanation. This Bureau is attached to a Department in which two kinds of scientific workers have their being. There are those whose primary interest is in some biological phenomenon and who use as experimental material the animal most suited for the particular investigation. There are others whose chief interest is in some one animal or agricultural practice, and whose activities are inspired by the problems of the livestock breeder. From the very outset of its task of organizing and distributing information, therefore, the Bureau has been doing double duty: in part it has been assisting agriculturists to keep abreast of such highly practical issues as the inheritance of milk yield or the genetics of disease resistance; and in part it has been tracing and obtaining obscure references to such subjects as the metabolic factors in sex-determination, the genetic aspects of human fertility and sterility, or the best methods of cultivating protozoa. All genetic knowledge is its province, while the economic difficulties of the British farmer and the Imperial husbandman must be its especial care.

The very breadth of this field has made it necessary to circumscribe our work, and to keep within the limits of current research, except when specific questions prompt us to follow up this or that line of inquiry. In response to such questions—to take two cases of interest to all husbandmen—we have compiled complete lists of all research done on the genetics of the pig and the horse (and hope shortly to issue monographs on these two animals); while a research worker sent us in pursuit of the weights of British and foreign horses—when we found, to our surprise, that very few breeders or owners had even an approximate idea of the weights of their own horses! I must confess, too, that the fullest and most thorough details came from Germany.

* Previous articles in this series appeared in the issues of this JOURNAL for August, 1929, and January, 1930.

The main part of our work hitherto has been concentrated upon the difficulties of stock-raisers in the tropical and sub-tropical Dominions and Colonies—such problems as combining the milk or beef qualities of pedigree European cattle with the general hardiness and resistance to trypanosomiasis, piroplasmosis, and other tropical diseases of the little, low-yielding, native cattle which are mostly of zebu type. The method most commonly adopted up to the present is the impermanent and rather wasteful one of utilizing only the first generation of the cross between the two strains. A few breeders, however, have already achieved considerable success by the methods of Bakewell, and in India, in particular, there have been built up several pure strains of zebu, which, without losing any of their natural adaptation to the Indian climate and soil, have a comparatively high and steady yield of milk—9,000 lb. or more yearly, according to strain.

None of the breeders, however, have yet tried—as we are now urging them to do—the experiment which might prove quicker and more effective than any—the Mendelian method. It consists in mating the F_1 hybrids *inter se*, and then in selecting from among their many progeny the one or two which show promise of combining natural adaptation with milk or beef qualities. Many stock-raisers have gone as far as mating the F_1 *inter se*, but have been so disappointed by the generally poor results—which, indeed, are only to be expected—that they have gone no further. They have not realized (1) that they ought to breed for large numbers of progeny in this, the F_2 generation, and (2) that among many very poor specimens will be one or two of real promise.

Our contact with these various problems of the Empire in general has made it evident that, if we are fully to understand the genetic factors involved in milk-yield—and those other qualities which are so highly developed in our own cattle—we must study them in breeds whose milking qualities are as yet undeveloped. Indeed, as the result of some recent investigations on these lines, I am hoping that we shall shortly have some specific facts of first-class interest to dairy-farmers in this country and elsewhere.

It was perhaps natural that, owing to the difficulty and delay involved in keeping touch with the outlying parts of the Empire, we should have concentrated most of our energies on that aspect of our work. The result, which is not altogether desirable, is that we now know far more about the problems and progress in research of such different places as Tasmania

and Tanganyika than we do of the difficulties of the British farmer. If only for this reason, I particularly welcome the opportunity to appeal here to those of the British Isles to make use of us and present to us our problems. For, let me emphasize this, no organization for the collection and co-ordination of information can act entirely on its own initiative. Its function, in the language of the daily Press, is to serve its public, and until we know "what the public wants"—in this case, a very specialist public—we cannot fulfil that function.

We do not expect to correspond direct with farmers and live-stock owners, except in special cases, as they will usually be better served by applying to the research and experiment stations in their own neighbourhood. Our "public," rather, falls naturally into two groups, the pure geneticists and physiologists who are attached to universities and biological research institutions both here and throughout the Empire, and the practical veterinary and agricultural officers who are responsible for the welfare and improvement of live stock in our far-scattered Dominions and Colonies. To the first we hope to supply a complete reference and bibliographical service on everything touching our wide subject, and so to replace, in some measure at least, the present unco-ordinated system of scantily financed libraries. For the second group we hope to become, as well, the co-ordinating centre—to keep them in touch with each other's work, with the progress of foreign Colonial officers similarly placed, and with those developments of pure science which bear upon their problems.

Now, the small world of pure geneticists and physiologists is already beginning to become aware of our existence and to utilize us for a variety of purposes ; so, too, as I have indicated, are Colonial officers. The special appeal I now wish to make, therefore, is to those engaged in research in practical breeding in England and Scotland—to inform us of their research, problems, and discoveries, and to ask our assistance in tracing references, in putting them in touch with others engaged in similar work, and in informing them of current progress in Germany and elsewhere—in doing, in short, all the hundred-and-one half-scientific, half-practical jobs which can only be done with the aid of a library and a staff skilled in the subject.

The Bureau, however, has ultimately another function—or at least I hope it has—than that of acting as maid-of-all-work in a household of farmers and geneticists : it is a function implicit in the very nature of the subject it surveys. Biology

is the science of life, and all biological details, howsoever separate and unconnected they may at first seem, are linked by some underlying law of life itself. For example, it does not at first seem a matter of very great significance that only men should suffer from that peculiar disease known as hæmophilia; nor are we unusually excited by the discovery—now well known—that by crossing two different kinds of poultry we are able from the colour of their down to tell the sex of the resulting chicks; while no one for a long time could account for the fact that the only tortoise-shell cats are all (with a few rare abnormalities) females. Yet, place these three facts together, and something of the profoundest significance emerges—the fact of sex-linkage, with all the light it throws on the fundamental mechanism of sex and the transmission of hereditary factors. The synthesis identifies the theoretical factors of Mendel with the actual chromosomes that the microscope reveals in the egg-cell. In just such a way did Mendel himself arrive at his results, and Darwin discover the truth of evolution by natural selection. Their synthetic genius discovered how a group of isolated facts fitted as smoothly into a law of life as pearls are run upon a string.

The Bureau, I hope, will prove, by the nature of its organization and classification, a mechanism for just that type of synthesis.

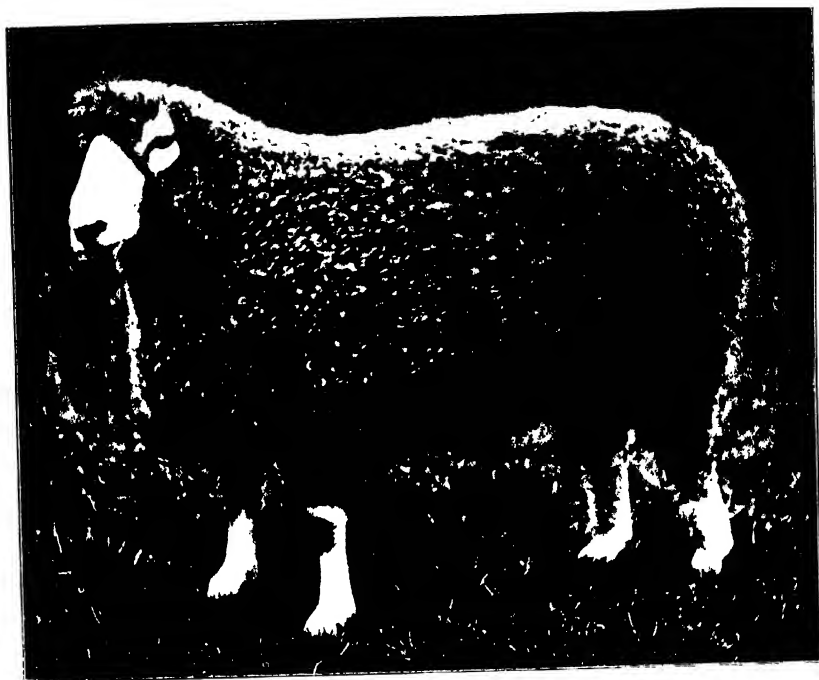
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SHEEP BREEDING IN NORTHUMBERLAND

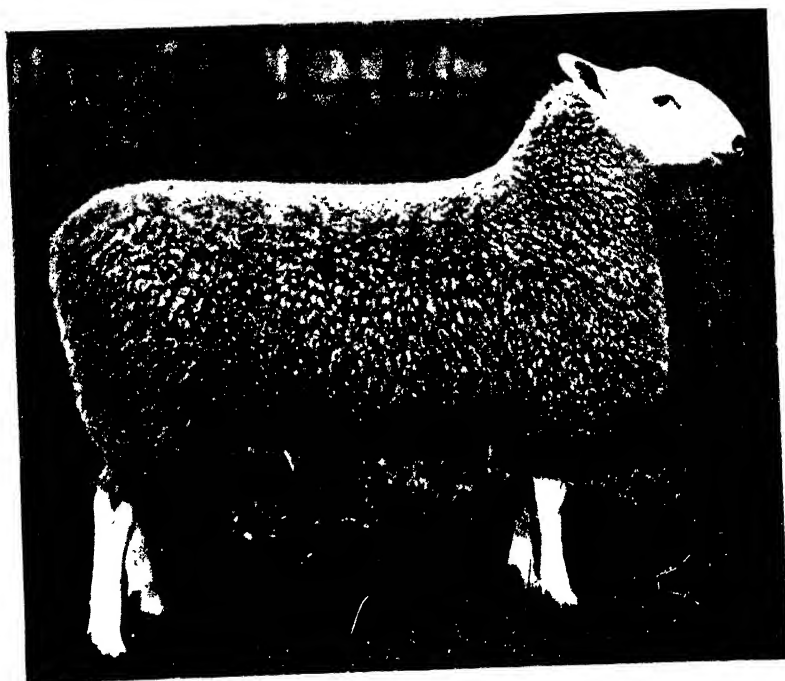
H. CECIL PAWSON,

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NORTHUMBERLAND has long possessed a distinguished reputation as a sheep county. Out of a total area of 653,807 acres under cultivation, 503,152 acres are under permanent grass, and it should also be noted, as influencing the extent of sheep grazing, that an additional area of 521,869 acres is returned as rough grazing. On this area of permanent grass, rough grazing, and a certain proportion of the arable under temporary grass, well over one million sheep are grazed, the actual return for 1928 being 1,157,481. If the Ridings of Yorkshire are taken as separate counties, Northumberland has the largest sheep population of any county in England. In common with other counties, the sheep population suffered considerable reduction during the war years; but, whereas



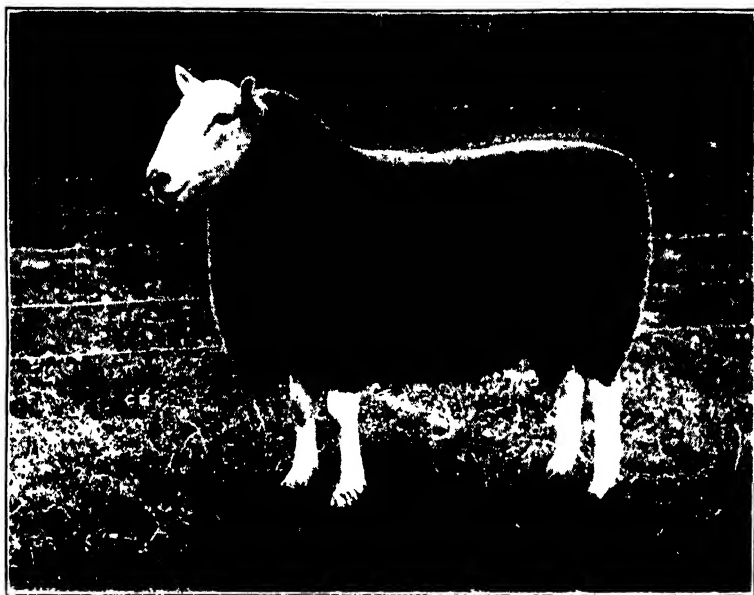
English Leicester Ram: A first prize winner.



Border Leicester Ram. A first prize and champion winner

SHEEP BREEDING IN NORTHUMBERLAND.

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Halibred Ram.

Copyright C. Reed



Cheviot Ewe.



Copyright - C. Reel
Cheviot Ginner. "Lady Dean," the property of Mr. John Robson. A first prize and champion winner.



Blackface Ewe.

Copyright J. Robson



Greyfaced or Mule Ewe (Border Leicester \times Blackface cross).

the total number for the country was reduced by about 27 per cent., Northumberland was affected only to the extent of about 13 per cent., i.e., as compared with the average for the years 1910-14.

The Northumberland farmer takes a special interest and pride in the sheep breeds and flocks of his county. Prominent events in his farming calendar are the annual store lamb and breeding ewe sales, at which thousands of sheep are disposed of, held at such centres as Rothbury, Alnwick, Wooler, Scots Gap, Bellingham, Hexham, Acklington and Morpeth. Sales of rams are also held at these centres, but the main disposal centre for rams in this northern area is the renowned annual show and sale held just across the border at Kelso in September.

Pure Breeds.—Northumberland has provided two of the most valuable pure breeds of sheep, namely, the Border Leicester and the Cheviot. Moreover, its old heath breed has played some part in the evolution of the breed commonly known as the Scotch Blackface. These are now the three most important breeds in Northern Britain, and their influence is considerable in the sheep farming of the country.

The Border Leicester originated through the activities of the brothers Culley, who introduced specimens of Bakewell's Improved Leicester (Dishley) breed into Northumberland in 1776. There is considerable evidence to show that the Culley Leicesters were kept pure, and, as the result of sales and letting of rams, several flocks were established in the north of the county and across the Border. They first received official recognition as a distinct breed, known as Border Leicesters, by the granting of a separate class in the Highland and Agricultural Society's Show in 1869.

The breed is most famed for producing rams to be used for crossing purposes. A big sheep, easily fattened, but of only fair quality of mutton, it is pre-eminently suited for using with hill ewes to give early maturing properties to the lambs. Large numbers of rams are sold at the annual autumn sales and are very extensively used in Border districts, Scotland, and the North of England for crossing chiefly with Cheviot and Scotch Blackface ewes. It has been stated that upwards of 90 per cent. of the rams sold are used for crossing purposes. The fineness of head and bone renders them fairly safe for use with the smaller mountain ewes, and little trouble is experienced at lambing. Standing well up on the leg—which gives them a particularly "leggy" appearance after

shearing—they are also very active, and thus well adapted for turning out with the ewes on the hills. The wool is long, close and wavy throughout its length, but not open to the skin.

The Cheviot breed is native to the districts surrounding the hills in the country of that name. Here they have grazed from time immemorial, and were commonly known in earlier years as the Long Breed, to distinguish them from the short or heath breed. They are now shorter, smaller and more compact than the former type. Low, in his later edition of *Domesticated Animals*, 1845, writes that “the beautiful breed of the South Down would seem to be of all others the best adapted to improve the Cheviot,” and it seems probable that rams of this breed contributed to the re-making of the Cheviot.

The Cheviot sheep thrive on very moderate keep, usually replacing the Scotch Blackface where the heather gives place to grass, even though the grazing is often of indifferent quality. The breed may be described as best suited to lower upland areas. The mutton is of good quality, and the ewes are good mothers, provided their natural food is not late in starting growth, a not unusual experience on north country hill farms.

The Scotch Blackface is smaller and hardier than the Cheviot, and thrives better on poorer types of grazing and at higher altitudes. Its natural home is found on heathery and moory land, but the older ewes are not uncommon as “flying” flocks on some of the poorer grazing of the lower land. This is the most numerous of any breed of sheep and is widely distributed over the Pennine range and Highlands of Scotland, being a typical mountain breed flourishing under high and exposed conditions. Youatt reported that “it is a common belief in Scotland (1837) that the Blackface sheep are of foreign origin.” David Low’s statement concerning the Scotch Blackface sheep that “this breed may be supposed to have found its way into Scotland by the mountains of the north of England” supports the fact of the Northumbrian old heath breed having influenced its development as already mentioned.

The Scotch Blackface is small but very hardy and active. A strong-boned, thick-woolled type is liked for the more exposed areas, and there is considerable difference in the quality of the fleeces.

First Cross Ewes.—The county takes considerable pride in cross ewes, namely, the Half-bred and the Mule. A marked development of more recent years is the increasing popularity

of these crosses, especially the Half-bred, with buyers from the south.

The Half-bred is the result of the cross between the Border Leicester ram and the Cheviot ewe, truly a Northumberland sheep, seeing both breeds involved have their home in the county. The cross ewe is prolific and hardy, and has become much in demand for Midland and southern farms as a grass-land sheep to replace arable folding flocks. When given fairly good conditions of grazing, it is questionable whether a better crossing ewe is obtainable, either for a "flying" or permanent flock. The ewes are excellent for crossing with Down breeds for the production of early maturing lambs for the fat market. The wool is close and thick, resembling more the Cheviot than the Border Leicester.

The Half-bred is unique in that if properly mated with half-bred rams it will continue to produce half-bred sheep. In former years "three parts" bred sheep were more common in the county than to-day, these being obtained by using a Border Leicester ram on Half-bred ewes.

The Mule is obtained by using the Border Leicester ram on the Scotch Blackface ewe. It is not generally considered as valuable a sheep as the Half-bred, but is hardier and, usually, a rather better milker. For the poorer lowland conditions it is more suitable than the Half-bred, for the latter needs fairly good grazing to do well. The Mule is perhaps not so prolific as the Half-bred, but the mutton is of better quality. Large numbers of Mule lambs, both ewe and wether, are sold for feeding at the annual lamb sales in the county. Often spoken of as the gray-faced ewe, it must not be confused with the cross popular on the west side of the north of England, which is the result of using the Wensleydale ram on the Scotch Blackface ewe, commonly described as Masham or gray-faced sheep. A type of Border Leicester ram, secured by selection, possessing a dark or blue face in contrast to the better-known White-faced ram, is generally preferred for crossing when the object is to breed mules. This type of crossing ram has rather stronger bone, and is generally considered hardier than the more common White-faced Border Leicester.

Crosses with South Country Breeds.—At Cockle Park, the Northumberland County Experiment Station, 150 Half-bred and Mule ewes are maintained as a permanent breeding flock. In earlier years, Oxford Down and Border Leicester rams were used. Over the years, on Half-bred ewes the Oxford Down gave slightly better results than the Border Leicester ram,

so far as fat lamb production was concerned ; but, on similar ewes, the Border Leicester was distinctly superior to the Oxford Down when the lambs were kept till they were shearlings.

Further trials have been made in more recent years with the Ryeland, Hampshire Down, Oxford Down, Suffolk Down, Oxford \times Border Leicester, and Suffolk \times Border Leicester rams.

The practice now at Cockle Park is to cross the Half-bred ewes with the Oxford Down, and the Mule ewes with the Suffolk Down, all the lambs being fattened off. These two crosses for fat lambs are, on the whole, the most popular crosses in the county.

When crossed with the Oxford Down, the Half-bred ewe produces a strong-boned, well-woolled lamb which makes for good appearance. It grows quickly and attains good size in a comparatively short time. The hardiness and vigour of this cross tend to satisfactory growth, even though the conditions are somewhat cold or exposed. The Suffolk Down on the Mule ewe produces a lamb of fine bone, a good feeder, and, because of its percentage of dead to live weight, particularly well liked by butchers familiar with the cross. Though not, as a rule, as big in appearance as the Oxford cross, it undoubtedly makes an excellent fat lamb and, given good conditions of grazing, does remarkably well. The rather better wool covering of the Oxford cross lamb, as compared with the Suffolk cross, and the stronger bone development are, however, advantageous in unfavourable seasons, particularly on farms which are rather late and cold.

General Management.—The management of the flock at Cockle Park is fairly typical of that obtaining on a lowland mixed farm where lambs are bred for feeding at an early age. The ewes are on pasture all the year round and are never folded on roots. From the beginning of the year they usually receive about $\frac{1}{2}$ lb. crushed oats per head daily, the amount being gradually increased until by March it is 1 lb., at which quantity it remains up to the middle of May. When snow is on the ground they each receive in addition about $\frac{3}{4}$ lb. of hay daily. During the same period a moderate allowance of roots is fed, the flock of about 140 ewes receiving about 12 cwt. of swedes daily, thrown out on the grass. After lambing, mangolds commonly replace the swedes as the root ration. Most of the lambs are fattened off on the wild white clover leys, and the remainder are fed off on grass with an



Suffolk Down \times Mule Cross Lamb.



Oxford Down \times Halfbred Cross Lamb.

SHEEP BREEDING IN NORTHUMBERLAND.

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allowance of turnips and $\frac{1}{2}$ lb. of mixed concentrates per head daily.

On the hill farms the rams are not turned out to the ewes until about the third week of November, hence lambing does not commence until April, and commonly extends into May. During the winter, the hill ewes receive only hay as additional feed, and then not until the depth of snow or condition of the ewes renders this a necessary procedure.

With the ram breeding flocks, as is the case further south, early lambing, more intensive feeding, early clipping, and special preparation for show and sale are prominent features indicating special management.

General Summary.—(1) One of the most marked changes of recent years is the increase in the production and sale of lamb and young sheep. As in other parts of the country, this trend towards early maturity has led to the disappearance of three- and four-year-old wether sheep, and to a decline in the number of sheep kept over one year old. The development in this direction is especially noticeable since the year 1925, as is shown by the following figures abstracted from the Ministry of Agriculture returns for Northumberland :—

Year					Number of sheep under one year	Number of sheep over one year
1925	..	..	..	..	507,687	140,276
1926	..	..	..	..	531,543	140,755
1927	..	..	..	..	559,025	128,744
1928	..	..	..	..	540,515	133,810

(2) Considerable improvement has taken place during the present century in the stock-carrying capacity of the grass land by means of phosphatic manurial treatment. This is particularly evident in the lowlands, but is also apparent on many upland areas; though to a more limited extent. Whilst this improvement has in many cases enabled farmers to graze more sheep—and in regard to hill farms larger and more profitable breeds or crosses—the largest increase in stock *pro rata* is in cattle. The increase in cattle stock grazed has resulted in a striking development of summer beef production, large numbers of imported Irish, home-bred Shorthorns, and Angus Shorthorn crosses being fattened off on improved pasture, which before treatment only carried store stock. As compared with the cattle population at the beginning of the present century, the number of cattle in the county has increased by about 36 per cent., whilst the increase in sheep is only about 10 per cent., *i.e.*, for the years 1900-27.

The advantage of the increase in cattle grazing is considerable, as with more even mowing of the grass, pasture land, inclined to become rough and patchy when grazed with sheep alone, is generally much improved for sheep grazing by the adoption of mixed stocking. The well-known grassland experiments at Cockle Park have demonstrated that, on slag-improved land, double the live weight increase per acre is obtained from the close, even grazing possible by mixed stocking than from the single stocking of sheep alone. This result at Cockle Park must be interpreted with caution, but it is certainly being advantageously applied on many hill farms.

(3) An arrangement, common years ago, of paying shepherds in stock, described as "pack" wages, is now practised only to a very limited extent. No shepherd's wages to-day consist wholly of stock. If any sheep are kept belonging to the shepherd, they represent only a portion of the whole wage. A full shepherd's wage may be taken at about 45s. per week in cash, along with the keep of one cow and follower. The aim of the "pack" wage was to give the shepherd a material interest in the general welfare of the flock. Mr. Robert Donkin, the well-known live stock auctioneer and land valuer of Rothbury, devised a scheme whereby the shepherds should have the return from so many ewes of the regular stock, and thus not actually own any of the flock as "packs." By this method he hoped to obviate the difficulty of the shepherd finding capital to "put on" the sheep, to remove for him risk of loss of ewes and lambs, and also to provide for the sharing of the returns in prosperous times. There are still a few shepherds partly on pack wages, mainly in the hill districts, but the custom is dying out. One weakness of the practice is the indefiniteness regarding the wage value of "packs" owned by shepherds.

Not a little of the success of sheep breeding in Northumberland is due to the fact that the Northumbrian farmer is a sheep-proud man, and in his efforts to realize his ambitions in this respect he is well supported by the services of shepherds of outstanding ability and worth.

[The Ministry is indebted to the courtesy of Mr. John Robson, Newton, Tarsset, for the photograph of the Blackface ewe facing page 1153.]

SOME RECENT INVESTIGATIONS INTO SUGAR BEET PROBLEMS*

III—RATE OF PRODUCTION OF SUGAR DURING THE GROWING PERIOD

(Concluded)

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and

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IN 1926, the Ministry of Agriculture and Fisheries suggested that it would be advisable to obtain figures of the rate of production of sugar in a beet crop so that some idea might be obtained as to the optimum period at which the crop should be lifted. The factories normally start their campaign early in October, and there was considerable uncertainty among farmers as to whether deliveries of beet at that part of the season did not prejudice the total weight of sugar. The work was undertaken at two centres and samples were drawn from selected fields of beet every week during the season. Records were kept of the climatic conditions, and at the conclusion of the experiments, just before the crop was lifted by the grower for despatch to the factory, an estimation of the number of plants to the acre was made.

The beets were selected by the process of walking down several rows and selecting every *n*th beet. At one centre the 50 beets so selected were sized into two similar samples and the two sets were used as a check one on the other. The differences between two such carefully graded samples differed from 0 to 0.5, equal to about 3 per cent. variation of the total sugar. At the other centre one sample of 50 beets was taken and the 50 "sawed" to obtain a mixed pulp. The beets were crowned in the field, and the weight of the tops and of the "roots" as ready for delivery to the factory were taken. On arrival at the laboratory the beets were carefully washed and the dirt tare calculated. The beets were pulped, the sample well mixed and the sugar determined by the Sachs-le-Docte method. The sugar in another sample of the pulp was estimated by the copper reduction method and the sugar calculated from the cupric oxide obtained.

Centre A.—For the first season (1926-1927) two fields were selected, one situated on a rather mixed type of soil derived

* The previous articles appeared in the issues of this JOURNAL for January and February, 1930.

from Old River gravels, the other on a heavy calcareous soil derived from the Boulder clay. The crop from the clay area was lifted rather early in the season to allow of winter cultivations. During the second season (1927-1928) a field on the same Old River gravel soil was used and the results compared with those from another soil of similar texture where the crop was very late sown and had suffered from the spring drought.

During the third season (1928-1929) two adjacent plots on the Old River gravel soil were selected and the resultant crops compared. Thus, samples of beet grown on the same farm were examined throughout the three years and gave an average result through three seasons, which differed widely in climatic conditions. In each case the samples were taken from a selected area of about one acre.

Tables XIII-XVII indicate quite clearly the effect of the season on the rate of sugar increase in the crop at this centre. The bonus offered by the factories for beet lifted in September was obviously insufficient to induce the farmer to lift his beet at that period and would have resulted in a considerable loss of sugar per acre. It will be noted in the 1926-1927 Old River gravel crop experiment (Table XIII) that beet gained very little sugar during the end of August, when, in any normal season, growth should have been most active. From August 18 to September 1 the sugar percentage rose from 18 to 21.1 per cent. This was due to the dry conditions and brilliant

TABLE XIII.—CENTRE A.—BEET GROWN ON OLD RIVER GRAVEL SOIL: SEASON 1926-1927

Date	Weight of tops	Weight of roots unwashed	Weight of roots washed	Condition of roots	Sucrose
	lb.	lb.	lb.		per cent.
Aug. 18 ..	15.25	15.5	15.25	No fanging : good shape	18.0
„ 25 ..	10.25	15.5	15.0	„	19.3
Sept. 1 ..	11.5	14.0	12.5	„	21.1
„ 8 ..	10.0	19.0	17.5	„	17.0
„ 15 ..	11.0	22.5	22.25	„	16.3
„ 22 ..	11.0	23.0	22.0	„	17.2
„ 29 ..	12.5	28.5	26.5	„	17.6
Oct. 5 ..	13.0	24.5	24.0	More fanged than usual	17.7
„ 14 ..	11.0	24.5	23.5	„	18.8
„ 21 ..	15.5	25.5	24.5	„	18.8

Beet per acre about 33,000.

TABLE XIV.—CENTRE A.—BEET GROWN ON BOULDER CLAY
SOIL: SEASON 1926-1927

Date	Weight of tops	Weight of roots unwashed	Weight of roots washed	Condition of roots	Sucrose per cent.
Aug. 18 ..	lb. 40.75	lb. 27.75	lb. 25.75	Badly fanged	13.8
" 25 ..	37.0	27.27	26.0	"	14.3
Sept. 1 ..	26.5	29.5	27.5	"	14.9
" 8 ..	25.5	44.0	40.5	"	14.8
" 15 ..	36.0	42.0	40.5	"	14.4
" 22 ..	33.0	41.5	39.5	"	16.3
" 29 ..	38.0	54.5	48.0	"	16.8
Oct. 5 ..	31.0	44.0	42.0	"	17.5

Beet per acre about 14,000 (many gaps in rows sown 27 inches apart).

TABLE XV.—CENTRE A.—BEET GROWN ON OLD RIVER SOIL :
SEASON 1927-1928

Date	Weight of tops	Weight of roots unwashed	Weight of roots washed	Condition of roots	Sugar per cent.
Aug. 18 ..	lb. 22.5	lb. 11.5	lb. 10.0	Nice even growth, fanged, but other- wise good	13.2
" 26 ..	27.0	15.5	13.7	"	14.4
Sept. 1 ..	24.5	14.0	13.0	"	14.8
" 8 ..	23.0	15.0	14.5	"	16.0
" 16 ..	27.0	19.5	15.5	"	15.7
" 23 ..	30.0	22.75	20.25	"	16.9
" 30 ..	26.0	22.5	18.6	"	17.3
Oct. 6 ..	20.0	25.0	21.0	"	17.0
" 13 ..	24.0	23.0	20.0	"	17.9
" 20 ..	24.0	25.5	23.0	"	17.6
" 27 ..	30.0	26.0	21.75	"	17.1
Nov. 3 ..	28.0	30.0	24.5	"	17.0
" 10 ..	25.5	28.0	21.75	"	17.0
" 17 ..	24.0	22.5	17.0	"	17.2
" 24 ..	28.5	29.25	23.25	"	17.3
" 31 ..	21.25	28.0	22.75	"	17.3
Dec. 8 ..	20.5	28.5	23.5	"	17.0
" 13 ..	18.5	27.0	22.0	"	17.8
" 13 ..	22.5	24.0	20.0	Set of bolted beet taken	15.6

Beet per acre about 34,700.

sunshine, which caused the crop to wilt while in the ground. After rain had fallen early in September the roots took up water, and consequently the sugar percentage of the roots

dropped, but the weight of the crop increased rapidly until the end of the month. It then remained stationary while the sugar percentage slowly rose to 18·8 per cent.

The heavy land crop of the 1926-1927 season was lifted early, while the sugar content was still rising steadily, to avoid the danger of carting on heavy soil when wet and to clear the ground for autumn tillage. In this case the grower had to sacrifice sugar yield for the convenience of agricultural operations. The sample on the Old River gravel soil in 1927-1928 was grown on a somewhat deeper and better textured part of the farm than that of the previous season. The growing season was characterized by dull, wet and cool conditions, unfavourable to the growth of beet. The lifting of the crop was delayed so that the series could be extended to the middle of December, and Table XV shows a fairly steady increase in the weight of the roots till the third week in October, while the sugar percentage reached its maximum by the end of September; this indicates again that a loss of sugar would have resulted had the crop been lifted early in the season.

The late-sown light-land crop, season 1927-1928, was grown on a rather heavy type of soil derived from a river gravel. The increase in sugar during the growing period was similar to the other plot, but the total amount remained consistently

TABLE XVI.—CENTRE A.—BEET GROWN ON GRAVELLY SOIL, SOWN LATE (SECOND SOWING): SEASON 1927-1928

Date	Weight of tops	Weight of roots unwashed	Weight of roots washed	Condition of roots	Sugar
	lb.	lb.	lb.		per cent.
Aug. 18 ..	17·5	8·5	6·4	Small, uneven growth, badly fanged	9·7
„ 26 ..	21·5	11·0	9·8	„	10·1
Sept. 1 ..	13·0	6·5	6·0	„	11·5
„ 8 ..	22·5	9·5	9·0	„	12·4
„ 16 ..	26·0	17·5	14·5	„	12·9
„ 23 ..	25·5	17·0	14·5	„	13·0
„ 30 ..	27·0	19·0	16·0	„	13·8
Oct. 6 ..	27·5	19·0	17·0	„	14·5
„ 13 ..	28·5	25·0	22·0	„	15·3
„ 20 ..	20·0	17·0	16·0	„	16·4
„ 27 ..	22·5	20·0	16·75	„	16·2

Beet per acre about 26,600.

TABLE XVII.—CENTRE A.—BEET GROWN IN DUPLICATE ON OLD RIVER GRAVEL SOIL: SEASON 1928-1929

Date	Plots	Weight		Weight of tops	Percentage	
		"Roots" dirty	"Roots" topped and cleaned		Dirt	Sugar
		lb.	lb.	lb.		
Sept. 13..	A	23.0	22.25	21.75	3.26	17.0
	B	16.0	15.5	13.50	3.1	17.3
,, 20..	A	26.75	26.25	22.25	2.9	18.0
	B	15.0	14.25	16.0	5.0	17.3
,, 27..	A	26.0	24.75	23.5	4.8	19.1
	B	18.0	17.0	15.0	5.5	19.8
Oct. 1..	A	22.4	21.5	17.75	3.9	19.2
	B	20.6	19.9	16.5	3.6	19.6
,, 12..	A	27.10	23.8	18.75	12.0	19.4
	B	24.5	21.5	17.5	12.3	19.7
,, 18..	A	36.6	30.75	28.25	16.0	19.3
	B	23.25	19.10	15.5	18.0	18.7
,, 25..	A	34.0	25.3	20.0	25.9	19.8
	B	24.25	20.1	16.0	17.1	19.2
Nov. 1..	A	38.3	30.15	24.5	21.4	19.3
	B	25.75	20.10	15.0	22.1	19.0
,, 8..	A	33.9	27.55	20.0	15.8	19.0
	B	26.25	21.10	18.0	19.8	18.4
,, 15..	A	35.3	27.5	18.0	22.0	18.3
	B	28.0	22.25	16.5	20.3	18.5
,, 22..	A	35.9	28.3	16.5	21.6	19.5
	B	28.25	23.75	17.0	16.1	19.3

Beet per acre: A about 30,000; B about 32,400.

Weight of unwashed beet per acre: A 17.25 tons; B 14.4 tons.

lower. In the season 1928-1929 the percentage of sugar reached its maximum in October.

Centre B.—The first two years' investigations were carried out on a typical soil derived from the Cornbrash. The third season's investigation was carried out on a soil derived from, and representative of, the Northampton sand. The number of beets were counted at intervals during the growing period.

TABLE XVIII.—CENTRE B.—BEET GROWN ON CORNBRASE SOIL

Date of sampling	Average weight of cleaned topped roots	Average weight of leaves and crown	Percent- age sucrose	Average weight of raw sugar	Number of beets per acre
		1928-1927	Season		
	oz.	oz.		oz.	
Sept. 9 ..	14	13	14.2	1.99	17,664
" 16 ..	16	18	17.0	2.7	17,648
" 23 ..	18	21	18.1	3.39	17,604
" 30 ..	24	23	16.1	3.9	16,960
Oct. 7 ..	23	20	16.5	3.79	16,956
" 14 ..	26	13	17.4	4.52	16,950
		1927-1928	Season		
Aug. 5 ..	0.52	3.08	9.45	0.049	—
" 12 ..	2.28	4.12	11.2	0.255	—
" 19 ..	6.28	14.4	11.2	0.703	17,168
" 26 ..	8.16	20.0	11.0	0.897	17,161
Sept. 2 ..	10.31	26.0	12.2	1.257	17,150
" 9 ..	14.56	29.76	11.8	1.718	17,142
" 16 ..	11.0	29.2	13.8	1.52	17,142
" 23 ..	16.3	29.76	14.15	2.30	17,101
" 30 ..	16.9	26.40	14.7	2.48	17,101
Oct. 7 ..	17.7	24.8	15.6	2.76	17,101
" 14 ..	17.4	26.9	16.1	2.80	17,101

TABLE XIX.—CENTRE B.—BEET GROWN ON NORTHAMPTON SAND :
SEASON 1928-1929

Date of sampling	Average weight of cleaned topped roots	Average weight of leaves and crown	Percent- age sucrose	Average weight of raw sugar	Number of beets per acre
	oz.	oz.		oz.	
Aug. 3 ..	3.3	7.5	—	—	33,500 an approximate stand of 90 per cent.
" 10 ..	4.3	10.0	12.30	0.528	
" 17 ..	6.0	12.4	13.00	0.780	
" 24 ..	8.1	15.3	14.45	1.170	
" 31 ..	9.3	14.9	15.30	1.420	
Sept. 6 ..	9.3	13.2	17.40	1.620	
" 13 ..	11.2	17.2	17.70	1.980	
" 20 ..	11.3	14.0	19.65	2.220	
" 27 ..	10.2	13.4	20.75	2.110	
Oct. 4 ..	12.5	12.9	20.95	2.580	
" 11 ..	13.4	16.1	20.23	2.710	
" 18 ..	16.0	15.5	19.00	3.040	

From the data in the Tables XVIII and XIX which represent the results obtained at this centre it may readily be noticed how extremely susceptible is the development of the sugar beet to slight variation in meteorological conditions.

Table XVIII shows the results of two consecutive years' trials on the same field (a good Cornbrash) under methods of treatment as nearly identical as possible, the only uncontrollable and variable factors being climatic. The weather during the growing period of the beet crop in 1926 was in general satisfactory; the fluctuation in sugar accumulation bears a distinct relationship to rainfall and sunshine. The following year, however, was almost disastrous in its effects, the cold and wet with its complement of sunless days being no doubt responsible for the enormous weight of leaf put up by the plant in its endeavour to produce sugar. The sugar per plant produced by the 1926-1927 crop was almost double that of the 1927-1928 crop, while the leaf area required for the production of the small amount of sugar in the season 1927-1928 was about double that required for the same quantity of sugar in 1926-1927. The number of plants per acre standing at lifting time in each year is very similar, and though it appears to be a small number for the total weight of beet produced it is not uneconomic since the number of beet is approximately 90 per cent. of the theoretical.

Table XIX shows the results of another series of experiments carried out on a light, hungry soil, under very favourable weather conditions in the season 1928-1929. The influence of strong sunlight and drought is well exemplified during the last week of August and the first week of September. The leaves were steadily wilting, and early in September were lying flat on the ground, their sugar-making powers being at a minimum with a consequent loss in their weight. The weights of the "roots" remained nearly stationary, but a steady concentration of sugar was taking place. About the middle of September the drought broke and an almost instantaneous revival followed; the leaves stood up and in two days had increased in weight with a subsequent increase in the weights of the "roots" and of the sugar.

The results of the two series are distinctly similar in the generalizations regarding the time at which maximum sugar content appears, and the susceptibility of sugar production to moisture and sunshine conditions. Unfortunately, space does not permit of the inclusion in this paper of any of the meteorological data collected day by day by the observers,

but full cognizance has been taken of those data in assessing the importance of the results.

Conclusions.—These results, taken over a series of three years at the two centres, and checked by samples grown in the same district but under different edaphic conditions, show a very fair uniformity and indicate quite clearly that early lifting means a considerable loss in total sugar weight to the grower. They also indicate the end of October as the period of optimum condition of the beet, both in sugar percentage and total crop weight from the farmer's point of view. The loss of plant which may result under unfavourable conditions was also demonstrated, as it may be considered that on light land about 36,000 to 38,000 beet to an acre, varying with the distance apart of the rows, is a full crop. Even under careful conditions of cultivation this maximum was not reached in any of the experimental plots, and in heavy land Boulder Clay soil only about one-half the theoretical number of beet were actually grown. It must be remembered that on heavy soils the beet are usually sown much wider apart than is the case on the lighter soils.

In conclusion, the authors desire to acknowledge their indebtedness to the Ministry of Agriculture and Fisheries for grants in aid of certain sections of the work ; to those land-owners and directors of experimental farms who gave facilities for the carrying out of the field investigations ; and to the many others who assisted in the technical work in the field and in the laboratory.

* * * * *

COUNCIL OF AGRICULTURE FOR ENGLAND

The thirty-second meeting of the Council was held on Thursday, February 6, 1930, at the Middlesex Guildhall, Westminster. Mr. R. G. Patterson, O.B.E., took the chair in the unavoidable absence, through illness, of Lord Strachie.

Grades of Milk.—*Mr. Denton Woodhead*, Chairman of the Standing Committee, reported that the Committee were going carefully into the question of the nomenclature of milk grades under the Ministry of Health's regulations, and hoped to be able to make recommendations in the matter at the next meeting of the Council.

Better Marketing of Home-Grown Agricultural Produce.—*Mr. Woodhead* moved the adoption of the Standing Committee's Progress Report on this subject (*see* Appendix I, page 1176). He made it clear that the Report did not pretend that better marketing would save agriculture. Indeed, paragraph 6 set out what the Standing Committee considered to be the limitations of the subject. He drew attention to the wide margin between the price to the producer and that to the consumer. Farmers on their side had to realize the value of co-operation for the purpose of selling. The individual farmer was not usually an expert salesman and should hand over the job to someone who was, and who would be working in his interest and that of his neighbours. Then the question of loyalty to the co-operative organization came in and they should not allow middlemen to ruin co-operative enterprise through such devices as paying them temporarily higher prices. He showed the Council a sample of flour sent from France for sale in the north of England at 1s. 6d. a stone. Wheat, to produce such a priced flour, could not be grown in this country. He asked the Minister what was to be done about it. Was the French flour to be allowed to capture our home market? It was for the Government, he thought, to devise ways and means of getting the home farmer a fair show in his own market. The idea of an Imports Board for foreign produce had been suggested, but politics came into that matter. At the last meeting members who declared themselves to be free traders had been heard to say, "Keep other people's goods out of the country until ours are sold." When that happened, he thought the Council was getting on. He suggested, however, that the potato position as regards imports of new potatoes should be examined. The public should be persuaded to buy the old potatoes, even if it meant

taxing the new imported potatoes to make them dearer. It was up to farmers to advertise the value of their own produce. English wheat flour should be bought more in the country districts, and English beer drinkers should ask for beer to be brewed from English malt and hops. The Committee had considered marketing questions at 52 meetings, had examined 73 witnesses, 32 of whom were agricultural experts, professors, research workers, 4 agriculturists, 28 commercial experts from within this country and 9 commercial and agricultural experts from overseas.

The Rt. Hon. Noel Buxton, M.P., Minister of Agriculture, said he considered the Report to be of considerable value. When he came into Office, he felt that the subject of marketing was the most prominent within his purview, and, with the peculiar political situation in which we were living, when no party had any chance of asserting the whole of its policy, it was in the sphere of marketing, and particularly in connexion with grading, that some good was to be achieved. He had found the Cabinet willing to spend a further £12,000 a year on the development of the subject within the Ministry. He thought it would not be out of order if he said a word or two about the Agricultural Conference now sitting. At the head of the list of subjects for the Conference was Marketing, and he would be betraying no confidence in saying that the Conference was already directing attention to it. The Government counted themselves fortunate to have been able to get the Conference together, and to have secured such eminent representatives of the three parties in the industry. He could say that he was deeply impressed with the earnestness and thoroughness with which the Conference had embarked upon its task.

He thought that paragraph 5 of the Report indicated too modestly the utility of the Committee's own contribution to the marketing movement, and all owed thanks to the Committee for its work. Producers were not, he thought, playing their part in the standardization movement, and they should themselves assist in greater publicity and propaganda on behalf of National Mark wares. In regard to all-English National Mark flour, there was certainly apathy on the part of the farming community in pushing its use amongst themselves and their friends. There were now eight agricultural products which were the subjects of National Mark schemes, and it was not sufficiently realized that the Mark enabled the full force of publicity to be brought to bear as a marketing assistance behind these products. Although it was our

national habit to move slowly, he hoped that when the public did move its interest in our national products would be all the more secure and confirmed.

The Minister then referred to the large opportunity given for greater and better fruit production through the development of the British canning industry, and dealt with a mis-statement which had recently been made in the Press as to the practicability of dealing with the strawberry by canning. As a matter of fact, it was one of our biggest successes in canning, and English strawberries led the world and had a great future before them.

Mr. Charles Roberts (Cumb.) thanked the Standing Committee for the work promised on the question of milk grades. In the Report, the possibility of using the National Mark on bottled milk of guaranteed quality had been mentioned. He thought the suggestion was of value and hoped that a scheme would be worked out. Attention might be directed to the organization of the milk industry as early as possible. The advantage in starting with milk was that you had not to deal with the problem of imports. The big question was the control of surplus, and if you controlled that, you controlled prices. He was not in the least anxious to see prices of milk raised, but was concerned to see that the price to the producer did not fall. Where the distributors were organized and the producers were not, there was bound to be a tendency for producers' prices to be downward, and he agreed, therefore, that capital was required for organization, and trusted that the Government would supply it on whatever reasonable terms they could. He would ask the Minister to begin with the north, as, in the south, milk producers were largely in the hands of great combines. *Mr. H. C. Gardner* (Worcs) thought that it would be better for the Minister to begin with potatoes. *Mr. W. W. Sampson* (Dorset) complimented the Standing Committee on their Report, particularly on paragraph 6. He agreed that marketing would not save the industry. *Mr. Woodhead* had said that the Council was not an executive body but only an advisory one. He would be content that the Council should be advisory, if he could feel that the Council's advice would be taken when sought or would be more fully considered. He thought it was the fact that, since the Council had been set up, many important pieces of legislation had been passed by successive Governments without advice being even sought. He, personally, was proud to be a member of the Council, but yet he found it difficult to get

other members of the Agricultural Committee to accept nomination. He rather felt it was because very little was known to come from the Council's discussions. He referred to recent events in farming history, and drew the conclusion that it was necessary for the Government to take action very soon or arable agriculture in England would be doomed. The last speaker had mentioned milk. In ten years' time if arable land went out, the country would be flooded with milk. With the Minister, he hoped that assistance would be got from the Agricultural Conference now sitting. *Mr. A. E. Bryant* (Bucks) commented upon the fact that the Marketing Report did not put out any scheme to save the industry. *Mr. W. Holmes* congratulated the Council on the Report, but asked for particular details supporting the statement that farmers and owner-occupiers of some arable land were being pressed to the verge of bankruptcy. He would like to examine balance sheets before the Council accepted such a statement. *Mr. Clement Smith* (E. Suffolk), speaking with an intimate knowledge of arable agriculture in the eastern counties, could only say that the statement in the Report was absolutely correct. The position was raised in the Council some twelve months ago when he gave figures. It was common knowledge amongst those who knew the position that this statement was absolutely correct. *Mr. R. Bruford* (Somerset) also spoke on the question of farmers' balance sheets. *The Chairman* pointed out that the Report under consideration was a marketing report and not intended to suggest a remedy for the present state of agriculture. *Mr. Denton Woodhead* replied to the various points that had been raised in the debate. The Report was then adopted by the Council.

Supply of Home-Fed Meat to the Forces.—*Mr. Woodhead* moved the adoption of the Standing Committee's Report on this subject (*see* Appendix II, page 1184), and called attention to the anomaly of the Government on the one hand telling the public to eat home-killed beef, whilst they fed the Forces on frozen beef at 5d. a pound. Practice was better than precept. The adoption of the plan suggested in this Report would be better than any amount of discussions and reports on the subject. He drew particular attention to the suggestion that the scheme might be tried out for the three months October to December next when supplies of home-killed beef were at their largest. *Dr. Addison*, Parliamentary Secretary to the Ministry, said that the Government was, as a matter of fact, going into the question at the present

time. He referred to the progress of the National Mark Beef Scheme and to the difficulties of extending it beyond London and Birmingham, in which cities it was being tried out at present. *Mr. J. Hamilton* (Lancs.) said he did not think that the supply of beef to the forces was affected by the National Mark Beef Scheme. *Mr. H. W. Thomas* (Hants) reminded the Council that he had raised this question on one or two occasions before. His view was that the Government should supply home-fed meat to the Forces at suitable times of the year when cattle were being sold at ridiculously low prices. He had been connected with an institution in Hampshire which applied for tenders for English cow beef as against imported beef, and they had been able to accept the tenders for the English and had since kept to it as it had given every satisfaction. The margin of difference in price was infinitesimal. He thought the Forces might be fed in the same way; at any rate in the autumn of the year. *Mr. W. B. Taylor, M.P.* (Norfolk), supported the resolution, and said he felt that the Council was in this instance knocking at an open door. *Col. Acland-Troyte, M.P.* (Devon), thought that the difficulties could be overcome with goodwill. The excuse given by the Minister in the House of Commons was that the supply of meat to the Forces might put the price up for other people. No evidence had been brought forward in support of this, and he would like to know why the reply had been given. *Brig.-Gen. Clifton-Brown, M.P.* (W. Sussex), asked whether Dr. Addison meant that he would accept the opportunity of supplying home-killed meat to the troops if it were graded under the National Mark. *Dr. Addison* replied that he accepted the principle embodied in the Report, but was unable to go beyond that at present. The whole matter was, as he said, being considered and various schemes explored with the utmost goodwill. He had mentioned the National Mark Scheme as he thought that the Council would be interested to know what progress was being made. He would not be a party to asking the Government to supply the most costly form of meat to the troops. *Mr. G. Hewitt* supported the Report, and said he wondered what the manufacturing people would say if we went abroad and bought the boots for our soldiers and sailors whilst our own manufacturing machines stood idle. It might cost more to provide home-killed meat, but surely it should be provided. The increase of meat production would certainly help arable agriculture through the root crops. He wondered how many members who were

Chairmen of Boards of Guardians had been applying for home-killed meat in the institutions of their own districts. Probably very few. In his own county they had tried it in one institution, at any rate, and it was successful. *Mr. George Edwards* agreed with *Mr. Hewitt* and said that the institution in question was one with over 1,000 inmates. The management had reversed the old policy and had provided home-killed beef.

The Report was then adopted by the Council.

Supply of Home-Grown Wheat for the Forces.—*Mr. Woodhead* moved the adoption of the Standing Committee's Report on this subject (see Appendix III, page 1185). He said that the Report was similar in character to the previous Report, and the Government here had an opportunity of giving the Forces better flour than they obtained under their present contracts, probably at a cheaper price. *The Minister* said that he would report the Council's proposals to the Prime Minister. The Government was warmly concerned for agricultural welfare, and the fact that a decision could not now be announced did not indicate any coldness or want of concern or desire to benefit the industry where possible. No party had yet indicated any willingness to take action which might affect the internal prices of foodstuffs. This particular subject had been one of frequent discussion between himself and the Secretary of State for War, and he (the Minister) had said that the amount of National Mark flour which the Forces could use would not be very great in proportion to the total production of it by authorized millers and packers, who now numbered about 160. The quantity of the "Yeoman" grade of flour would, however, probably not be sufficient to meet the public demand if large quantities were diverted to military depots. His representation to the Secretary for War was, therefore, that National Mark flour, other than for bread-making, should be used by the Forces. On the general question of the public use of National Mark flour, he would say that some of the National Farmers' Union branches had taken active steps to encourage its sale in their districts, and this was an activity which all agriculturists should copy. He hoped before long to be able to announce the result of his representations on the subject of the Report.

The Report was adopted by the Council.

The Royal Veterinary College and Veterinary Education and Research.—*Sir Arthur Hazlerigg, Bart. (Leics.)*, moved:—

"That the Council of Agriculture for England desires to express its grave anxiety concerning the present position of veterinary

education in Great Britain as shown in the Report of the Departmental Committee on the Royal Veterinary College. The Council therefore requests the Ministry of Agriculture to obtain authority to take all necessary steps to put the veterinary education and research in this country on a sound basis as suggested by the Departmental Committee. The pressing need for an adequate supply of highly efficient veterinary practitioners and research workers, not only in this country but in the British Empire, makes this matter one of great urgency."

He said he was sorry that Mr. Dallas, whose name appeared on the agenda as mover of this resolution, was unable to be present through business in the House of Commons. Mr. Dallas had asked him to move the resolution, and he was very pleased to do what he could. He thought that the Council might fairly ask the Ministry to take authority to do what the Departmental Committee had suggested. All members had read the summary of the Committee's conclusions, and realized that the Royal Veterinary College was the premier veterinary institution of the Empire. The Committee had said that the present housing conditions of the College constituted a national disgrace. It was not the fault of the present Governors, or of any particular Government, but it seemed a national duty now to provide funds to rebuild the premises and to give any necessary additional impetus to the various energies of the College. Sir Arthur dealt at length with the need for improved veterinary education in the country, and the necessity of prosecuting research into animal disease. The Departmental Committee recommended the sum of £300,000 for capital expenditure, and £20,000 a year for upkeep. It seemed a large sum, but was no more, apparently, than the purpose required. Perhaps the Ministry might devote to this object some of the money which was being allocated to other objects, *e.g.*, the appointment of additional Agricultural Organizers. He thought that most counties would be willing to wait a year or two for these if the Ministry could meet the urgent needs of the Royal Veterinary College first. He noticed that the first President of the College in 1791 was the Duke of Northumberland. If another site or additional land were required, he understood that the present Duke had suitable land which might be used for the purpose and which he might be able to offer. *Mr. Hamilton* seconded the motion.

The Minister said that he fully realized the seriousness of the position. In the last financial year, excluding capital grants, the money spent on veterinary education and research had been £45,000, £10,500 of which went for Foot and Mouth Disease research, and £10,200 on the Animal Pathology

Research Institute at Cambridge. It was felt that the total was inadequate to the large subject. In research, a scheme for expansion of the Ministry's own laboratory at Weybridge was being considered, and further additions at Cambridge, but it was not possible to expand without a corresponding increased supply of trained men, and for these he looked to the veterinary colleges, and, above all, to the Royal. He accepted the general outlines of the Committee's Report, and was now approaching the Treasury in the matter. He thought that the Council might rest assured that the Government would do everything reasonably possible to promote the objects of the resolution. *Mr. Gardner* urged the necessity of more thorough veterinary education amongst the practitioners in the country.

The resolution was put to the meeting and carried.

Licensing of Bulls.—*Sir Merrik Burrell, Bart.* (W. Sussex), moved the following resolution :—

“That the Council of Agriculture for England adheres to its previously expressed opinion that all bulls over nine months old should be licensed. It considers that legislation to this end is more than ever needed. It therefore urges the Minister of Agriculture to accept the general principle, and to lay a draft Bill before a conference of those primarily interested in order that the details of its application may be agreed before a Government measure is introduced into Parliament.”

Sir Merrik said that the Standing Committee had sent a deputation to the Minister to place before him the general fact that he had a larger backing of agricultural opinion for this scheme than he was aware of. This Council itself had on several occasions passed unanimous resolutions in favour of doing away with the scrub bull. Now the Council was an advisory body, and there was apt to be dissatisfaction at the attitude of the Government towards it. The resolution asked two questions : First, did the Minister agree to the principle of registration of bulls, and secondly, would he lay a draft Bill before a conference of people primarily interested ? *Sir Merrik* added that the proposal was generally supported by the Royal Agricultural Society, the Agricultural Committee of the County Councils' Association, the Central Milk Recording Council, and other bodies. Licensing was more than ever needed, as the country was being used more and more for live-stock production, and it was bad business to grow inferior animals when it was as easy to breed good ones. Medium and poor lands were the ones that were going down to grass, and on these better-class animals should be bred to be fed on the richer lands. *Sir Arthur Hazlerigg* seconded the resolution,

making reference to the success of the scheme in Northern Ireland and to the fact that agricultural opinion was now strongly behind this measure.

Dr. Addison, in reply to Sir Merrik Burrell's two questions, said that the answer to the first was in the affirmative, though the Government had to consider the political and parliamentary situation. The answer to the second was that a Bill was in draft, and that a considerable time had been spent upon it. The question was what sort of opposition would be likely ; the Government was a minority party and could not expect to pass in a crowded session any Bill that was not an agreed Bill. A conference had been called for early next week with some of those whom the Ministry thought might be hostile to the scheme. He was hopeful that the opposition would be removed. ●

The resolution was put to the meeting and carried.

Serious Situation of Potato-Growing Industry.—*Mr. J. T. Briggs* (Soke of Peterborough) moved :—

“ That the Council of Agriculture for England calls the attention of the Government to the serious condition of the potato-growing industry in England, and urges immediate inquiry into the matter with a view to ascertaining the best ways and means of assisting the industry.”

Mr. Briggs said that there were thousands of tons of potatoes for which it was impossible to find a market. He estimated that £10 an acre would be lost to growers in this country ; an aggregate loss of £5,000,000. He thought that the low price of corn had contributed to an increased acreage of potatoes. The importations from April to July came at a time when the stock of our own old crop should be in process of being consumed. He thought that these imports should be held off the market. The Empire Marketing Board might usefully assist by advertising our home crop against the foreign early potatoes which commanded ridiculous prices. He suggested that a Committee be formed to consider the matter at once. *Sir Douglas Newton, M.P.*, seconded the motion, and referred to the various methods adopted abroad for utilizing surplus crops by manufacture into commercial alcohol. Then there was the question of exports. Canada had discovered disease in our potatoes and was excluding them, paying about £20 a ton for its own allowed imports. This question should be tackled from the point of view of removing that embargo.

Dr. Addison said that there were two active schemes already afoot, (1) by potato producers themselves and (2) by a conference organized by the National Farmers' Union. He agreed with Sir Douglas Newton that the question should be examined in its broadest aspects. As to stopping imports from abroad, if this country started that kind of thing, foreign countries might reciprocate. He noted that the exports of potatoes to France in 1928 were 54,000 cwt.; in 1929 they were 921,000 cwt.; in 1928 the exports to Spain were 290,000 cwt., in 1929 they were 653,000 cwt. The Ministry had given a great amount of time to the consideration of this question in concert with the interests concerned, and were prepared to do everything possible to assist a comprehensive marketing association and any forms of research.

Mr. Cecil Robinson (Holland) referred to the extraordinary position in the Holland districts. Agricultural labourers had nothing to do, and potato growers were at their wits' end. The County Council had 13,000 acres of smallholdings, the rents of which were too high to grow cereal crops; their potatoes this year had failed to bring them any proper returns. He strongly supported the formation of a small committee to consider the whole question. *Mr. W. B. Taylor, M.P.*, also referred to the very serious plight of the industry, and suggested that a Committee of five members should be appointed to co-operate with the Ministry in the matter. After further discussion it was agreed that the matter should be referred to the Standing Committee for early inquiry.

The resolution was put to the meeting and carried.

APPENDIX I

REPORT FROM THE STANDING COMMITTEE ON THE BETTER MARKETING OF HOME-GROWN AGRICULTURAL PRODUCE

General.—(1) We have, in the last few years, given a good deal of consideration to the question of the better marketing of home-grown agricultural produce. We have made several reports on individual commodities, which have been adopted by the Council and printed and circulated throughout the counties. It appears to us now that the present is a suitable time to review the situation as a whole and in detail.

(2) At the outset, we desire to record our appreciation of the value of the information which the Ministry of Agriculture has collected and published in Orange Books under the headings of the different commodities. Acting on that information and under the authority of the Agricultural Produce (Grading and Marking) Act of 1928, the Ministry has drawn up and put into operation several schemes directed towards the improvement of marketing methods in the interests of the producer. At the same time, the schemes perform a definite service to the consumer in that they supply him with commodities of graded

and guaranteed quality, which are the result of more general standardization of production and marketing. It is because of this standardization that the movement is enhancing the reputation of home-grown products, and therefore the demand for them in this country.

(3) We are convinced that the advance which has been and is being made will prove eventually to be of considerable benefit to the industry. We consider also that without the energy, skill and tact, which the Division of the Ministry dealing with the matter has displayed in the face of very considerable difficulties, little, if any, progress would have been possible.

(4) We understand that the Ministry is now proposing, with financial assistance from the Empire Marketing Board, to undertake the study of business organization in the marketing of agricultural and horticultural products, i.e., in the working of the different kinds of federations, pools, buying and selling and other agencies. The question of better marketing will thus be led to the next logical step after standardization has been achieved, viz., sale by organized methods which obtain the best possible results both for producers and consumers.

(5) Our own, and the Council's, part in the movement has been to inquire into the position in regard to the chief agricultural commodities and, as a result, to suggest to the industry and the Ministry certain courses of action. We have followed up, step by step, the advances which the Ministry has made, and we are glad to know that our suggestions, which have been adopted by the Council, have in every instance been carefully considered by the Department, and, where possible, followed. It has also been a part of the usefulness of the Council's and the Committee's deliberations that they have secured a certain amount of much-needed publicity to the movement and to some of its more important details.

(6) From the standpoint of immediate benefit, it seems to us necessary here to say that schemes for better marketing, which can in any case be only slowly applied to the industry, will not save it from the decay which, at the moment, threatens certain parts of it. On all hands there is reported a steady persistence of yearly losses on arable farming which are, in many instances, pressing the tenant farmer and the owner-occupier to the verge of bankruptcy. These cases occur in increasing numbers, especially in the corn-growing districts of the Eastern counties, and wherever, in fact, the market for the chief cash crop in the rotation—cereals—gives the farmer—in spite of his annually renewed hope to the contrary—a price which is less than the cost of production. With high cost of production, and low world prices for cereals and the dumping of still cheaper bounty-fed grain, the corn-growing farmer on any but the best soils is in a position where better marketing alone is unable sufficiently to assist him. To do that, it requires to be accompanied by a national plan whereby prices will be maintained at a level which will give him a chance of profit. Some of the other sections of the industry, however, are not in so perilous a plight, and these should be able to benefit now, and considerably, by the better marketing methods which the Ministry is putting forward and which are the subject of the following statement.

Earlier Reports.—(7) The first report to the Council on the subject of the improvement in marketing was adopted at its meeting of October 20, 1927. As a result of it, we were asked to prepare a report dealing generally with the needs of the principal commodities, and we accordingly presented a report—known as the Interim Report—under date January 19, 1928. This report has been followed from time to time with specialized reports each dealing with separate agricultural commodities, as desired by the Council.

Home-grown Fruit.—(8) The Interim Report foreshadowed the progress which has since been realized in the grading and packing of certain home-grown fruits, and the use of the National Mark on all standardized produce sent out in non-returnable packages in place of the old cumbersome returnable.

(9) The first products to be brought under the National Mark as authorized by the Agricultural Produce (Grading and Marking) Act, 1928, were apples and pears. The scheme came into force on September 1, 1928, and allowed any grower of more than 1,000 bushels of apples or 500 bushels of pears—in the case of Doyenne du Comice, 250 bushels—to become a registered packer under the regulations and to use the National Mark on his packs. Fruit packed under the Mark soon found a ready sale at good prices, and the number of registered packers grew with the public demand for home-grown fruit of guaranteed quality. Whereas in the first season there were 54 registered packers of these fruits, for last season the number became 71. The quantity of fruit packed cannot readily be estimated, but, if the number of National Mark labels issued by the Ministry is any indication, it must have given a very fair start to the scheme. In the two seasons, 1928 to 1929, about 400,000 labels were issued, which should mean that a substantial proportion of the best quality apples and pears grown in the country have been sold under the National Mark. There is, however, still room for an increase of the service, and more and more of the best fruit grown in the country might, with advantage, both to producer and consumer, be packed under the Mark.

(10) Incidentally, the scheme shows up the need for better quality in much of the fruit brought to market. The lesson suggests that poor-yielding trees, and those of unsuitable varieties for a district, should be grubbed up or grafted with better kinds, as expert knowledge dictates. Many more of the better varieties of apples and pears can be found growing room in suitable districts where they are known to do well. In case of doubt, the County Agricultural Organizer is always in a position to advise farmers and others (1) whether fruit can be grown in a district, and (2) as to the best and most suitable varieties. In the increased production of the better kinds of fruit it must not be forgotten that one of the chief factors is the proper spraying of the trees against insect and fungus pests. It may be advisable in some growing seasons to spray fruit trees as many as four or five times to be sure of obtaining good supplies of the best quality fruit.

(11) One of the reasons why the market for fresh fruit may be expected to expand rapidly is the extraordinary growth of the canning industry in this country. There are now over 30 canning establishments as against but two or three a few years ago, and it is anticipated by authority that the total output of English canneries will double itself in volume in the course of the next few years. There is certainly a growing demand among the public for canned English-grown produce, which is probably the best in the world, and if it can be brought under the National Mark, as was recommended in our special report on Canning (adopted January 24, 1929), considerable additional impetus should be given to sales. We gather that arrangements with the National Food Canning Council and the trade for standards for syrup and other liquids used in canning the various fruits and vegetables, and also for qualities of fruit and vegetables themselves, are being worked out, and that, before very long, a scheme should be produced, agreed with the Canning Industry, for applying the National Mark to its products.

(12) The retained importations of canned or bottled fruit and vegetables into this country amount to about three million cwt., valued at £7,000,000 per annum, so that the capture of the foreign

trade, or a large part of it, by our own canning industry presents a formidable task. It has been commonly supposed that second-rate fruit and vegetables are good enough for canning. This is not so: only the best produce grown of varieties suitable for canning is welcomed by the factory. In our special report above referred to, we recommended that contracts between canners and growers for supplies of certain varieties at definite prices should be the regular practice in the industry. It would give growers the certainty of a good market for fresh fruit, and would ensure for canners a supply of suitable produce. There seems to us every reason why this should be done, inasmuch as, assuming a ready demand and a stable market which are certain to be established because of the quality of the produce, the price of the raw material can be fixed within comparatively narrow limits beforehand, since the cost of canning is known. The knowledge of this one factor, the assurance of a certain steady price for fruit, would probably do more to make the canning industry immediately successful than any other single factor.

(13) We are informed that there is a prospect of fresh strawberries, cherries and plums being brought under the National Mark in the course of the coming season, as well as cider brewed from home-grown apple juice. This will present a very considerable advance in facilities to improve fruit marketing.

Home-grown Vegetables.—(14) We have not yet considered, either in the Interim Report or in a special report, the position in regard to vegetables. The only aspect of their marketing which we have reviewed is in regard to canned products (special report, adopted by the Council, January 24, 1929). There is, however, a large field of inquiry to be covered before the marketing position of vegetables can be fully envisaged. We hope before long to be able to make an inquiry and to report to the Council upon it.

(15) The Ministry has, so far, inaugurated two schemes dealing with vegetables: (1) for tomatoes and cucumbers, operating from April 1, 1929, and (2) for export broccoli, operating last spring. Though the tomato and cucumber scheme has been working for one season only, and there are about 100 packers of National Mark produce, it cannot be said that the scheme has been yet sufficiently taken up. Many growers do not yet seem to be fully aware of the value of the National Mark label on their packs. Now that foreign tomatoes will soon be required to be marked as such on sale, it is more than ever necessary for the home-grown produce to be packed and graded and properly presented on the market. If it is not, it may suffer in comparison with foreign produce, and this it should not be allowed to do. There is no better method of achieving the desired end than by the use of the National Mark.

(16) As regards export broccoli, the scheme operated only for two months last year, from mid-February to mid-April. It is functioning again this year. The export was, last year, to Belgium and Germany, and was in competition with supplies ordinarily sent from Brittany and Italy. The broccoli, graded to definite standards and sent in non-returnable wooden crates, bearing National Mark labels in French or German, was well received, the prices realized being on the whole satisfactory. This is the first instance of a market garden industry in this country being organized to capture foreign markets.

Home-grown Potatoes.—(17) The problem of better marketing of this crop, in view of the large variations of quantities grown and of importations from year to year, is admittedly very difficult. We referred in our Interim Report to a better system of sorting on the farm and grading for market so that the trade in home grown potatoes should be able to acquire and retain the reputation of dealing in clean

and sound produce only. In the special report to the Council, dated June 1, 1928, we went further and suggested a scheme for organizing the export trade in seed potatoes, and also plans for dealing with surplus crops of "ware" potatoes in seasons of plenty by export for food, or by drying and preserving, or by manufacture into potato crisps. It was evidently not possible in the short time between a realization of the essential weakness of the national potato position and the failure of the market for the 1929 crop to work out and establish an effective organization for the disposal of surplus potatoes, and the industry now has large stocks unsold on hand. We hope that the public may be induced to use these in quantity and in preference to imported early potatoes, which are of very little taste or nutritive value. The lesson will, however, now have been learnt, and potato growers will see the wisdom of combining for dealing both with the grading of produce for orderly sale and with any surplus crops.

(18) The Ministry's main activity in this matter, since the issue of the Potato Marketing Report, has, we understand, been directed to the production of regulations defining grades of quality. These definitions are necessarily complicated, but they have been demonstrated many times by the Ministry during the past year at a number of agricultural shows. They provide for variations in size, i.e., minimum diameter of the tubers as between one grade and another, and for a common standard of dressing as regards disease, damage, dirt, etc. For various reasons it is not possible, apparently, at present to suggest the use of the National Mark in connexion with the sale of potatoes.

Eggs and Poultry.—(19) In the Interim Report we discussed the establishment of depots for collecting, packing and grading eggs under National Mark regulations. We suggested that these depots might be used also in connexion with the conditioning, killing and grading of poultry for market. In this connexion it is interesting to note that plans for the grading of dressed poultry under National Mark regulations have recently been published by the Ministry.

(20) A special report on Egg Marketing was presented to the Council on January 24, 1929, and the National Mark Egg Scheme, which had been launched a month or two earlier, came into operation on February 1, 1929. The scheme met with the usual initial difficulties, but soon proved that the service which it performed for the public, namely, the grading of fresh home-produced eggs according to weight and the speedy and safe transmission of them to the table, was one which was greatly needed. The number of registered packers of eggs is now 153, of whom about one-third are co-operative associations or are governed by producers themselves, or in their direct interests.

(21) Following the National Mark Scheme for Eggs, came the marking of preserved eggs as such, as from March 1, 1929, and the marking of imported eggs under the Merchandise Marks Act as from April 21, 1929. On this last date, also, British cold- or gas-stored eggs were required to be marked on their emergence from store. These arrangements brought about the position that the only unmarked eggs allowed to be exposed on the home market were home-produced fresh eggs.

(22) It is interesting to record that a number of public authorities, such as the Metropolitan Asylums Board and various Boards of Guardians, now specify for National Mark eggs in their contracts.

(23) The importation of eggs into the United Kingdom is in the region of 30 hundred million, and the home production in England and Wales is about 18 hundred million, so that, allowing for a fair home production in Northern Ireland and Scotland, and a necessary importation of some inferior eggs, there would still be room for the

production in the United Kingdom to be doubled before the country becomes completely self-supplying, on the present basis of consumption.

(24) Since February 1, 1929, about three million National Mark labels have been issued to accredited packers of eggs, and a reasonable estimate is that about 250 million eggs have been packed and sold under the Mark in the last twelve months. This is a very fair proportion of that part of our total output which has to move out of the producing areas to find a market. It rests mainly with the public, who, no doubt, desire to have a graded and guaranteed commodity at a reasonable price, to bring about a rapid extension of the use of the Mark, and they can do this by insisting on being supplied with National Mark eggs for all purposes.

Wheat, Barley and Oats, and Cereal Products.—(25) The next considerable subject tackled under the National Mark was all-English flour. Our Interim Report dealt generally with the question of marketing cereals, and we prepared a special report on this subject which was presented to the Council at its last meeting on October 31, 1929. The difficulties of the question will, therefore, be fresh in the minds of the Council.

(26) The Ministry's National Mark Wheat Flour Scheme was brought into operation on October 1 last. It provided for three grades of flour being marked, namely, "All-English (Plain)," "All-English (Self-raising)" and "All-English (Yeoman)," and within a few weeks a large number of millers and bakers had come into the scheme. The figure up to date is 161. This of itself shows the demand that has arisen for all-English flour for one or other of the purposes for which the different grades are suitable. The chief object of the scheme is to establish the credit of all-English flour as against imported flours. In some years, home-grown wheat, as all farmers know, may have a high moisture content, and for that reason will not bake into so many loaves as the harder imported wheats which, in bread-making, absorb large quantities of water. There is, however, a flavour and a quality about bread made from English flour which should recommend it strongly to the public, and the need, therefore, was for a plan by which English flour could be guaranteed as such on the market. This the Ministry's scheme amply does, and the success which is attending it should, with better advertisement of the flour, establish the home-grown commodity in its rightful place amongst the bread-making flours of the world. We consider that this object might be helped still more by fixing a statutory maximum limit for the water content of the loaf. This would assist to overcome some bakers' reluctance to use English flour and would also bring a real improvement in quality of all bread.

(27) The National Mark Scheme of the Ministry dealing with Malt Flour and Malt Extracts, which came into operation in December last, is of assistance in increasing the demand for home-grown barley. With importations of cheaper malt and barley from abroad many brewers have, in the last season or two, turned away from the home market for a good deal of their barley, leaving barley growers to take, for much of their good crops, the price of mere feeding barley for stock purposes. This and the introduction of cheap wheat and oats from Germany has raised the cereal marketing problem into a national one. It appears to us to be a matter of the first importance that the buying by our own subsidiary industries, such as brewing, should be directed as far as possible to the products of our own soil.

(28) The National Mark Malt Scheme is the first effort which has been made to encourage users of barley products to use exclusively the home-grown commodity. The scheme divides malt extracts into three grades, "pharmaceutical," "veterinary" and "baker's," the

first two grades allowing the admixture of cod liver oil. The Association of Malt Product Manufacturers have given an assurance that, subject to malt extracts from grain grown in this country being graded and marked under the National Mark, they will use British malt extract exclusively. There are already 35 firms registered as authorized packers of malt products.

(29) It is hoped that the Ministry will see its way to follow up this scheme with another, viz., the grading of all English barley malt for British beer. It is to be expected that the public would not hesitate to show a strong preference for beer made from all-English malt—and possibly all-English hops—if it were guaranteed to them by the National Mark on the cask or bottle.

Home-killed Beef, Mutton and Pork.—(30) The marketing of cattle, sheep and pigs has been dealt with by the Committee, both in the Interim Report and in the special report of October 8, 1928. On October 4, 1929, the Ministry put into operation its experimental scheme for the grading and marking of home-killed beef in the London area. A month or so later the scheme was extended to the Birmingham area. Further developments are understood to be in contemplation, and seem to be justified by the success so far achieved.

(31) The scheme lays down three classes of English beef: "Select," "Prime" and "Good"; the "Select" being beef from specially fed, early maturing, cattle killed soon after reaching the "baby-beef" stage; the "Prime" being similar to "Select," but larger beef from somewhat older cattle; and the "Good" being beef mainly from well-grown bullocks and heifers, and including some first-class young cow beef. Each of these grades meets a somewhat different class demand. The grade and national marks are applied to the outside of each carcass by a roller stamp in such a way that all the principal joints are covered. The public of London and Birmingham, therefore, know when they are buying the best kinds of home-killed beef by the stamping upon the joint. They are invited to take special note of the quality and to insist on being supplied with it every time beef is ordered. It is hoped that the scheme will be extended to other localities at the earliest possible date, and that before long each large municipal abattoir will have an official grader attached to it, who will apply the Mark to all home-killed beef which reaches the requisite quality.

(32) The schemes, both in London and Birmingham, have gone ahead rapidly, and since their operation, to January 23, 1930, about 35,700 sides have been graded by the Official Graders in a progressively increasing number week by week, with the exception of the pre-Christmas weeks when numbers were heavier. The present average is understood to be about 3,500 sides a week under both schemes. It should be much greater in the future. National Mark beef is now being specified in public contracts, and it is in use at the House of Commons and most of the London clubs. Hotels, restaurants and others are taking a keener interest in the matter, and are finding it very much to their advantage to supply customers with the superior meat of this country.

(33) As regards the better marketing of mutton and lamb, it seems to us important that steps should be taken in the matter as early as possible. The difficulties in the way are, no doubt, considerable in view of the many varying qualities of the meat, but that of certain breeds at certain ages is fairly constant where the breeding and feeding are good, and grades for these could probably be defined. The Ministry, however, will, no doubt, be prepared to bring mutton and lamb under the National Mark as soon as circumstances permit, but the event may perhaps be hastened if farmers themselves will press for it and

show a readiness to co-operate in a country-wide scheme for the purpose. Already, as is well known, imported mutton is mistaken in many households for English, and the sooner this error can be rectified, the better, in the interests of the home producer.

(34) The question of the standardization of home-killed pork and bacon is receiving the close attention of the Pig Industry Council, which has only recently issued an important Interim Report advising the general use of the fine-boned Large White boar in pig breeding. The question of the better marketing of pig products is one fraught with exceptional difficulty, but we do not despair of the business being eventually placed upon sound lines in this country, in the same way that it has been in certain Continental countries. We are convinced that the basis of any sound marketing scheme is consistent and standardized production. The time should come when the public, at any rate those who are prepared to pay for the better article, will turn to importations only exceptionally, and when the English product is not available. We are convinced that there is a great future for the business of home pig-production, if it can be properly and economically run on the lines of a national scheme.

(35) We also hold the view strongly that in improving the marketing of all classes of meat, the elimination of inferior breeding animals should be one of the first steps to be taken.

Home-grown Wool.—(36) There is no recent progress on this subject to report beyond the fact that one or two other co-operative wool societies are being established in the country. The position in wool marketing was described in our special report of May 4, 1929. It is hoped that the Ministry will soon be able to work out a scheme for the application of the National Mark to clean wools of well-known breeds and descriptions, and so assist in the better marketing of this commodity in the same way as assistance has been given to others.

Milk and Milk Products.—(37) We dealt with liquid milk in the Interim Report, and made more careful and considered suggestions in our special report on Fresh Milk, dated January 1, 1928. Our general conclusion was that milk-producing farmers ought to be better organized to control their own commodity up to the time of handing it on to the wholesaler for distribution to the public, and we pointed to certain successful co-operative milk producers' societies as examples of what might be done. We suggested that such societies might usefully link up with industrial co-operative societies and that the National Farmers' Union branches might function as local agencies in arranging the terms of contracts between producers and wholesalers, and for dealing with the manufacture of surplus milk into cheese, and with other by-products. We also suggested that all milk retailed should be of high quality, bottled, properly capsuled and labelled with the proper designation of such milk (pasteurized or otherwise) and, where possible, with the name of the district in which it was produced.

(38) We did not go so far then as to suggest that the National Mark label should be used. Little improvement in the general position seems able to be recorded since our report, so that more active steps in producers' interests seem urgently called for. We are aware of the administrative and practical difficulties, but we suggest for this purpose that a scheme be worked out by which the National Mark can be used on bottled milk of guaranteed quality. This should, incidentally, have the effect of giving a further impetus to milk consumption in this country.

(39) The marketing of cheese, butter and other dairy products has not yet been considered by the Committee. The National Mark has

not been applied to any of them, although in certain districts grade marks have been applied to brands of cheese, *e.g.*, Cheddar and Cheshire. We hope to be able to examine and report upon the whole question before very long.

Conclusion.—(40) The foregoing sums up the present marketing position as we see it. There is no doubt whatever that, broadly speaking, the improvement which has been achieved in the last few years is striking, and that still further progress may be looked for in the immediate future. The only comment which we have to make as regards the relative activities of those chiefly concerned is that the producers are not pulling sufficient weight in their own interests. The National Farmers' Union has given great help, we know, but we think that, individually, producers should assume a keen and active interest in all marketing affairs; they should be ready to follow any sound lead which is seen clearly to be in their interest, and generally to play their part in organized propaganda and publicity on behalf of the National Mark which, after all, is the trade mark of the home producer. Wherever the National Mark is employed, producers should insist on their own supplies being brought under it, and themselves become working advocates of the system. Their friends in town and country, all of whom are consumers, should be brought individually to realize the value of home-grown produce as guaranteed under the Mark. With such a position achieved, with the loyal co-operation of traders in whose own interest it is to stock goods of undoubtedly high quality, and with the intelligent appreciation of all consumers, not only of the value of such goods, but of the national issues at stake, there should be no difficulty in maintaining British products in their rightful place—at the head of the Home Market.

January 30, 1930.

APPENDIX II

REPORT FROM THE STANDING COMMITTEE ON HOME-KILLED MEAT FOR THE FORCES

(1) The late Government, before going out of office, stated its intention of supplying home-killed beef to the Army, Air Force and Navy (when in home ports) for the six months, October, 1929, to March, 1930. The proposal was not put into effect, as the present Government declined, in July last, to adopt it.

(2) The cost of supplying meat for the Army, Air Force and Navy in the Mediterranean was stated, in answer to a Parliamentary Question given in February, 1929, to be about £860,000 for the year 1928, of which £830,000's worth was frozen—nearly all from the Empire.

(3) The estimated extra cost of supplying home-killed meat for two days a week to the Forces was stated to be £140,000 per annum (February, 1928). It may be assumed, therefore, that the extra cost of supplying home-killed meat all the week for six months would be roughly in the neighbourhood of £245,000 per annum; six-sevenths of this would be likely to be beef (£210,000).

(4) The present supply of beef is understood to be nearly all Empire frozen, which is bought at the low figure of about 5d. a lb. We understand also that the War Office still asks for alternative tenders for frozen and home-killed beef in Scotland, the South-Western District, and at stations where under 100 lb. of meat a day is consumed. The disparity between the prices of Empire frozen and home-killed is, however, so great that home-killed is practically never purchased.

(5) With the National Mark Scheme for beef going well in London and Birmingham, and pointing the way to an extension to other parts of the country, the demand for the "Select," "Prime" and "Good" qualities of home-killed beef is likely to improve, and prices for English beef should be well maintained. If home-killed beef were to be bought by the Forces in place of frozen, the effect on prices would be to stiffen them until the supply throughout the year had been increased to meet the extra demand. This would have an altogether salutary effect upon the industry.

(6) If a scheme for the supply of home-killed beef were then after all to be arranged, it would probably be advisable for the buying to start in the autumn of this year when the flush of grass-fed cattle comes upon the market. The longer the notice that can be given to the farmer, up to a point, the better, so that he can prepare to meet the demand. It is suggested that only beef graded and marked under the National Mark should be purchased for the Forces. That would at once simplify the business of buying and help the Government schemes for improved marketing. If the effect on ordinary retail prices were feared, the scheme might be tried out for the three months October to December next when supplies of home-killed beef will be at their largest.

(7) It should be remembered that the term "home-killed" may include Irish Free State beef, and might, if the importation of Canadian cattle is resumed, include Canadian. It might be practicable to require cattle from those countries to be fed for at least three months in Great Britain or Northern Ireland before they can come under the category "British home-killed" for this purpose.

January 30, 1930.

APPENDIX III

REPORT FROM THE STANDING COMMITTEE ON ALL-ENGLISH FLOUR IN BREAD FOR THE FORCES

(1) The proposal of the late Government to include up to 25 per cent. of all-English flour in bread for the Forces was considered by the present Government in July last, and it was decided not to give effect to it.

(2) It does not appear likely that any extra cost to the Army, Navy and Air Force would ensue if the proposal were adopted. All-English flour is certainly not greater in price than the ordinary mixed flours used in baking. It is assumed that the Forces use the ordinary bread-making flour of commerce in cases where the bread is baked at their own depots. Such flour would include, at times, a proportion of English, but would be unlikely to include so much as 25 per cent.; the same would be the case with bread bought already baked.

(3) Since July last, the National Mark all-English Flour Scheme has come into operation. National Mark "Yeoman" flour is now widely used for bread-making in this country; indeed, it is being successfully used for the purpose without mixture with any other flours. The other classes of National Mark flours—"Self-raising" and "Plain"—are also being used for making biscuits, pastries, pies, puddings, etc.

(4) If National Mark all-English flour, whether "Yeoman" or other, were now to be used by the Army, Navy and Air Force, besides resulting probably in economy for those Departments, it would simplify buying, as the Government contracts would specify National Mark flour of the particular kinds required, which are graded by very definite specifications under the Ministry of Agriculture's scheme.

Furthermore, buying by the State would assist this scheme, which is in itself a desirable object; and it is difficult to see how, where no extra cost is involved, the State can justify ignoring the scheme in its purchases; the case is stronger where a definite economy is likely, coupled with a probable actual improvement in quality.

(5) It is not possible for the Committee to suggest what proportion of English flour should be used in the bread made in the Army, Navy and Air Force depots; it might be found expedient and satisfactory to use even 100 per cent. "Yeoman" flour. But with regard to bread bought ready baked, it is suggested that 25 per cent. English flour might be specified in all contracts as the minimum to be used.

(6) As regards the purchase of flours for other culinary purposes, it is suggested that the Army, Navy and Air Force should be requested to restrict their contracts entirely to National Mark all-English flour.

January 30, 1930.

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MARKETING NOTES

National Mark Eggs.—February 1 saw the anniversary of the inception of the National Mark Egg Scheme, and it may be useful, therefore, to take stock of the present situation. The Scheme, although a voluntary one, has undoubtedly established itself and is having a marked influence upon the British egg trade.

National Mark Eggs have secured pride of place in the wholesale markets and have been successful in replacing imported supplies in many quarters. The Scheme, too, has had the effect of improving the general level of egg marketing technique throughout the whole industry, and testing and grading are now much more widely practised. It is estimated that during the last twelve months, between 200 and 250 million eggs have been marketed under the National Mark, representing a very fair proportion of that part of the country's output which has to move from the producing area to find a market.

In view of the fact that the present annual importation of eggs into Great Britain is in the neighbourhood of 2,800 millions, while home production is only about 2,300 millions, it is clear that there is ample room for a great increase in home production. The growing success of the National Mark Egg Scheme is assisting to this end. The Scheme has performed a distinct service (1) to the producer, in that it has established the tested and graded home-produced egg in its rightful place on the market; (2) to the distributor, in that he can handle National Mark Eggs with confidence and obtain continuity of guaranteed supplies; and (3) to the consumer, in that he is

assured of the quality and weight of the eggs packed under the National Mark.

At the present time, the number of authorized packers in the Scheme is over 150 and, although some packers have for various reasons withdrawn from the Scheme, or had their certificates revoked by the National Mark Committee, a number of packers report substantial increases in turnover. This development has been particularly notable in the case of some of the co-operative packing stations. Finally, the market for National Mark Eggs is expanding in all directions; as an illustration, one firm of wholesale egg merchants is now selling between 400 and 500 cases of National Mark Eggs per week, whereas its trade in the national product six months ago was nil. Reports from other firms confirm the keenness of the demand.

To make the National Mark Scheme still more effective, certain amendments are now being introduced in the light of experience. Following a recommendation submitted at last October's Conference of National Mark Egg Packers, a proposal to amend the existing statutory grades was placed before the Minister's Poultry Advisory Committee, after having received the approval of the various national bodies concerned. The Committee agreed to the proposed amendments and action is now being taken to issue revised regulations under the Agricultural Produce (Grading and Marking) Act, 1928, prescribing new grade designations which will come into force on March 10, 1930. These are as follows:—

HEN EGGS.			DUCKS EGGS.		
<i>Grade</i>	<i>Designation.</i>	<i>Minimum Egg Weight.</i>	<i>Grade</i>	<i>Designation.</i>	<i>Minimum Egg Weight.</i>
Special weight	..	2½ oz.	Special duck	..	2½ oz.
Standard weight	..	2 oz.	Standard duck	..	2½ oz.
Medium weight	..	1½ oz.	Medium duck	..	2½ oz.
Pullet weight	..	1½ oz.	Small duck	..	2 oz.

National Mark Malt Products.—The Minister has appointed Mr. R. A. Wallis to be a member of the National Mark Malt Products Trade Committee, as a representative of the consumers' co-operative movement. The following additional firms have become enrolled as authorized makers and packers, and have joined the National Mark Malt Products Association—

Fairbank Kirby (Grimsby), Ltd.

Perry & Hope, Ltd., Glasgow.

National Mark Malt Extract and Malt and Oil are now on sale in retail chemists' shops throughout the country. Arrange-

ments have been completed for the distribution of large quantities of leaflets and display cards to members of the Retail Pharmacists' Union and other retailers, many of whom have expressed keen interest in the Scheme and promised their active support in furthering the sale of National Mark Malt Products.

National Mark Beef.—The National Mark Beef scheme continues to make steady progress in London and Birmingham. The number of sides of beef marked with the National Mark each week since the week ended January 11, 1930, has been as follows :—

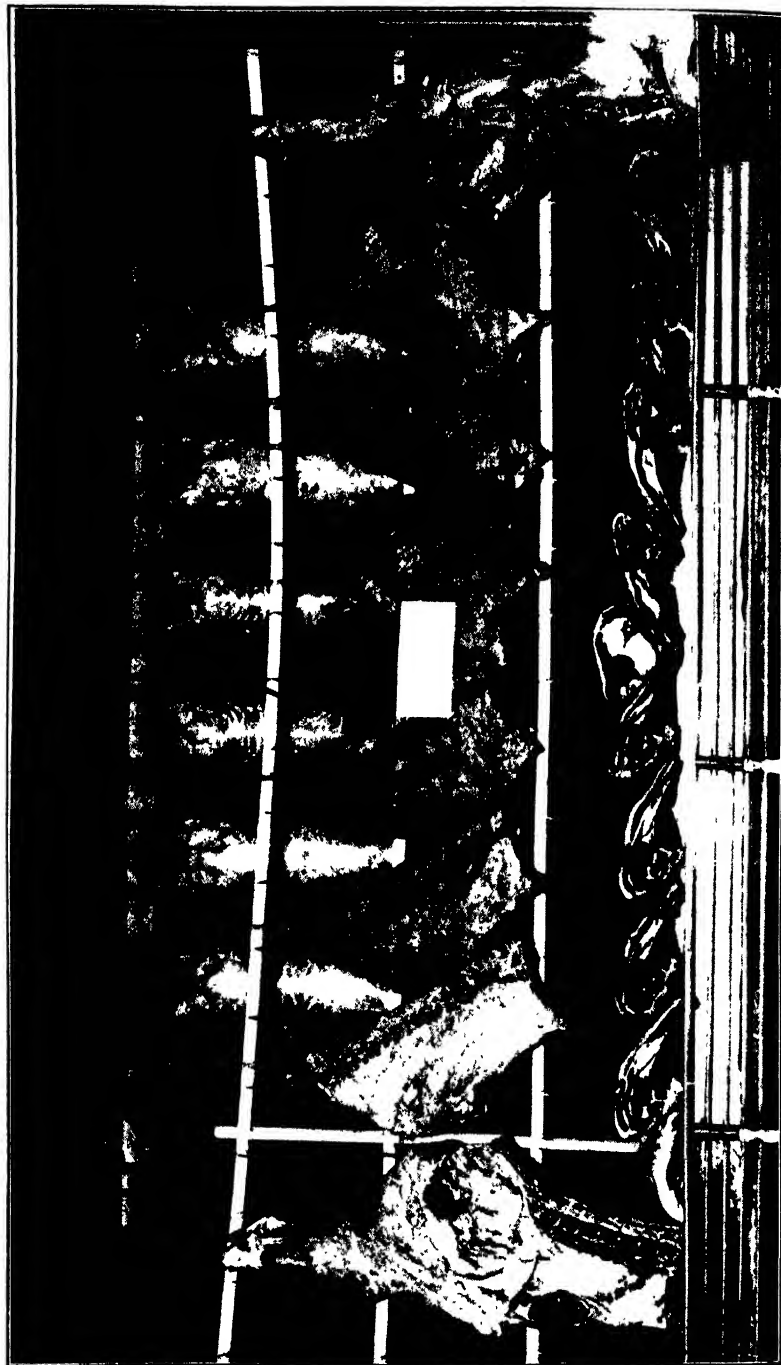
<i>Week ended</i>		<i>Select.</i>	<i>Prime.</i>	<i>Good.</i>	<i>Total sides Marked</i> (Quarters and pieces omitted).
LONDON					
January	18 ..	598	414	33	1,045
January	25 ..	690	462	59	1,211
February	1 ..	511	322	19	852
February	8 ..	433	551	33	1,017
BIRKENHEAD*					
January	18 ..	5	182	36	223
January	25 ..	2	170	37	209
February	1 ..	2	162	20	184
February	8 ..	17	142	16	175
SCOTLAND*					
January	18 ..	1,415	136	—	1,551
January	25 ..	1,618	193	—	1,811
February	1 ..	1,642	182	—	1,824
February	8 ..	1,591	158	—	1,749
BIRMINGHAM					
January	18 ..	32	249	69	350
January	25 ..	14	273	109	396
February	1 ..	35	273	88	396
February	8 ..	13	354	25	392

* Sides consigned to Smithfield Market, London.

The number of shops on the roll of London meat traders selling National Mark beef on February 1 was 1,029, and on the Birmingham roll 439, although in regard to the latter, the number of shops where marked beef is regularly on sale is considerably less. Wide publicity is still being given to National Mark beef. A photograph of a display given in one of the Birmingham restaurants faces this page and another, of a display of marked beef for the House of Commons kitchen, faces p. 1189. In the week beginning February 24, a further intensive publicity campaign in the West of London and in Birmingham was undertaken by the Ministry in conjunction with the Empire Marketing Board. An Advisory Committee, representative



Display of National Mark Beef at a Birmingham Restaurant.



Display of National Mark Beef, supplied to the House of Commons Kitchen, January 21, 1930.

of the beef feeders in the seven counties from which *Birmingham* draws its main supplies, is being formed with the co-operation of the National Farmers' Union.

One interesting and anticipated result of the scheme is the effect it is having on the demand for quality in beef supplies. Where retailers have stocked National Mark beef, they are almost necessarily bound to continue to offer the grade with which they have supplied their customers. As the scheme is worked at present, there is still coming on the market a certain amount of beef which is not graded before arrival at Smithfield Market, London. Prospective buyers of this beef will frequently, before buying the beef, ask the graders what grade it would be put into, and, in fact, buyers now usually require to know the grade before purchase. It is further clear that there is a marked preference for the "Select" and "Prime" grades, at any rate in London. Feeders producing cattle for the London market would therefore be well advised to see that their cattle are sufficiently well finished to reach one or other of these grades. It will, however, be satisfactory to note that, in the London area, the number of sides at present falling in the "Good" class is very small in comparison with the other grades.

National Mark Wheat Flour.—Reports from authorized millers and packers give widely different accounts of progress under the Scheme. Some millers have experienced little or no demand for National Mark flour, and have not seen their way to make any special efforts to create a demand. Others have taken steps to circularize their customers with a view to creating a demand, but with no better results. The principal difficulty in both cases seems to be that the miller's own trade is in 280-lb. and 140-lb. sacks, and that these firms do not customarily offer pre-packed flour to retail distributors.

On the other hand, in districts where authorized packers are able to cater for the retail trade, the reports are very different. Bakers and grocers find their trade in National Mark flour to be rapidly increasing. One baker in the Walthamstow area reports that the National Mark has more than doubled his flour trade since last October. Three instances have been brought to the Ministry's notice in which the active co-operation of County and District branches of the National Farmers' Union with local millers and retailers, in advocating the consumption of National Mark flour by the agricultural community, has had a marked effect in stimulating the demand. This is notably the case in the March district, where the response to the appeal is described as "wonderful." "Yeoman" grade flour is being used by a

considerable number of bakers, and the results are said to be satisfactory. In this area, simultaneous advertisements by the Farmers' Union, a local miller and a local baker appeared in one of the county newspapers. In the other two cases, combined advertisements in the official organs of the local branches of the National Farmers' Union were supplemented by editorial appeals, and "display weeks" for National Mark flour were arranged with the co-operation of civic authorities and retail shops. The Ministry commends these examples of self-help to the interests concerned in other areas. If the agricultural community would make its voice heard in demanding National Mark flour—which is exclusively made from home-grown wheat—there would be immediate benefit to the home wheat-growers.

On February 10, the Minister announced in the House of Commons that the Secretary of State for War had already given instructions that National Mark flour should be given a trial, for purposes other than bread-making, at stations where there are Army bakeries, and where, consequently, flour is required in comparatively large quantities. In the case of other stations, where requirements are smaller and where flour for cooking purposes is usually obtained from the bread contractor, it has been arranged that, as supplies of National Mark flour may not always be obtainable at or near the market price, alternative quotations for National Mark flour and for other varieties shall be invited, and that those for the former shall be accepted if the price is not higher than that of any other variety.

National Mark Fruit (Strawberries and Cherries).—Consideration has been given by the Ministry to the possibility of marketing strawberries and cherries under the National Mark, and draft schemes are now being prepared for submission to the National Farmers' Union and other national organizations concerned. It is hoped at an early date to bring the schemes to the notice of growers in the respective districts. Should the schemes meet with the approval of the interests concerned, it is proposed to bring them into operation in time to deal with the crops of 1930.

National Mark Scheme for Dressed Poultry.—In 1926, following an intensive investigation, the Ministry issued its Report on the Marketing of Poultry in England and Wales (Economic Series No. 11). During the ensuing three years, the Ministry has arranged at Agricultural Shows a large number of practical demonstrations of the best methods of conditioning, grading and packing poultry for market. The time is now

ripe for the launching of a National Mark Scheme for dressed poultry, and a draft scheme has accordingly been submitted to the Poultry Advisory Committee. The Committee have provisionally adopted the scheme, which has been referred to national organizations of producers and distributors for consideration. The views of these bodies will be considered by the Poultry Advisory Committee, and it is hoped that the scheme, with or without amendment, will be brought into operation in June of this year.

Displays of Home Produce.—A display of home-grown produce was staged at the British Industries Fair at Olympia from February 17 to 28.

The showcase in the foyer of the Birmingham Hippodrome, referred to on p. 1088 (February, 1930) of this JOURNAL, proved to be a centre of great attraction. During the month, National Mark Flour, Malt Products, Beef and Eggs were exhibited in turn.

Starting on February 17, a National Mark fortnight was organized in Leicester with the support of the Lord Lieutenant of the County, the Lord Mayor of the City, and Members of Parliament representing both County and City, and with the co-operation of a local Committee under the Chairmanship of Mr. T. Hacking, the Agricultural Organizer for the County. For this period, the Ministry rented from the Corporation an empty shop in a prominent situation and arranged therein a display of National Mark products. The movement was supported by leading retailers in the City.

Markets and Fairs in England and Wales.—*Welsh Markets, London Markets and Final Review.*—Number 26 of the Economic Series of publications of the Ministry of Agriculture and Fisheries,* now issued, contains in one volume Parts V, VI and VII of the Report on the "Markets and Fairs of England and Wales." This Report, of which Parts I, II, III and IV appeared as Economic Series Nos. 13, 14, 19 and 23, respectively, is thus completed. Taken as a whole, it forms a comprehensive and detailed survey of the markets and fairs of the country, which every market owner and all members of market committees and auctioneers should possess. The Report is of value not only to local authorities and others concerned in the control of markets, but also to producers and distributors of agricultural produce generally.

* Published by His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 6d., post free, 9d.

Part I was a general review of market conditions in this country, while Parts II, III and IV were surveys of the markets and fairs of the Midland, Northern, and Eastern and Southern counties respectively. Part V, in the present volume, deals with the 242 markets and 570 fairs held in Wales. Like its predecessors, it is divided into three sections. The first section deals with systems of ownership, the distinctive features of markets for various types of commodity and the nature of market charges, and also includes a chapter on the rapidly declining Welsh fairs. The second section consists of brief descriptions of market conditions in each county in relation to local agricultural conditions, and of short notes on those markets in each county which present features of special interest. The third section consists of detailed descriptions of the markets in six of the most important market centres in Wales.

The appendices to Part V form a complete guide to the markets and fairs of Wales. They include a list of all markets, arranged county by county, with particulars of ownership and such details as the market days, commodities sold and methods of sale, a list of all agricultural fairs with their dates and type, and a statement of the approximate numbers of livestock sold at each fair or market.

Part VI is devoted to the London markets and exchanges. An opening section, giving a brief outline of the markets and exchanges for each commodity, and dealing with certain general considerations such as the types of ownership and the charges in London markets, as well as with the problem of London market congestion, is followed by detailed descriptions of all the London markets and exchanges for agricultural produce. The market facilities are described and an account is given of the business carried on in each case. A comprehensive list of all the London retail markets and all the wholesale markets and exchanges handling agricultural produce, with details as to ownership, market days and commodities sold, is given in an Appendix, while a second Appendix supplies a list of all the street markets which are a characteristic of London retail marketing. Part VI should be of great value to producers and distributors all over the country on account of the national importance of many of the London markets and exchanges as central clearing-houses for agricultural produce.

Part VII is a final review made in the light of the investigations on which the Survey is based, dealing with a number of general questions with respect to the methods of market control and market charges, and the working of the markets

themselves. It is hoped that full advantage will be taken of the opportunity which is now available of obtaining the complete series of this Report,* which is a comprehensive and otherwise unobtainable guide to the markets and market practices of this country.

German Potato Mark.—Interesting developments are taking place in Germany on the lines adopted in this country for the sale of home produce under a National Mark.

German markets are at present being plentifully supplied with graded potatoes in containers bearing a suitable distinguishing mark as a result of the introduction of grading and marking schemes in the Province of Saxony, Free State Saxony, Province of Hanover, Rhenish Province and Silesia. In these provinces, the growers have combined to form non-trading Mark Potato Associations, each of which is responsible for the supervision of the grading and marking scheme in its own area.

The Mark is used in connexion with culinary potatoes of standard quality, and may only be applied to potatoes grown by members of a recognized Mark Potato Association. Further, the Mark may only be applied to certain varieties which have been approved by the Chamber of Agriculture on account of their flavour and cooking quality.

Members of an Association must notify the Provincial Chamber of Agriculture early in the season with regard to the crops being grown. The potatoes are inspected at the time of growing and must be certified as true to type, normally healthy and of average uniformity in growth of the tubers. The inspection is carried out by agents of the Associations acting under the instructions and control of the Chamber of Agriculture.

The grade standard of dressing may be illustrated with

* Report on Markets and Fairs in England and Wales :—

Part I : General Review (Economic Series No. 13). 6d net, post free 8d.

Part II : Midland Markets (Economic Series No. 14). 6d. net, post free 9d.

Part III : Northern Markets (Economic Series No. 19). 6d. net, post free 9d.

Part IV : Eastern and Southern Markets (Economic Series No. 23) 6d. net, post free 9d.

Parts V, VI and VII : Welsh Markets, London Markets and Final Review (Economic Series No. 26). 6d. net, post free 9d.

Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, or through any bookseller.

reference to the specification adopted for the Hanover Mark, which is as follows :—

The potatoes must be hand sorted, sound, clean, dry and true to type. Round varieties as delivered must be from 5 to 8 centimetres in diameter and no potato must be less than 4 centimetres in diameter. Long varieties should be from 6 to 10 centimetres in length and none less than 5 centimetres.

Defects must not exceed the following limits, viz., admixture of other varieties 1 per cent.; earth 1 per cent.; slightly damaged 2 per cent. (seriously damaged, 1 per cent.); dry rot 1 per cent.; slightly scabbed 3 per cent. (seriously scabbed, nil); other disease or damage (external or internal) 2 per cent.; wet rot, nil; total combined defect, 10 per cent.

When delivery is made from dark soil, this fact must be expressly stated. Each sack must bear the Mark in the form of a seal, and special conditions have been drawn up to cover the sale and delivery of the potatoes.

Members of the Mark Potato Association are bound to offer their stocks of "Mark" culinary potatoes through a distributing agency which has been given the sole monopoly of Mark potatoes.

The Pig Industry.—An interim report of the Pig Industry Council follows immediately below, and a note thereon will be found on p. 1142.

* * * * *

THE PIG INDUSTRY IN ENGLAND AND WALES

INTERIM REPORT OF THE PIG INDUSTRY COUNCIL

To the Right Honourable NOEL BUXTON, M.P.,

MINISTER OF AGRICULTURE AND FISHERIES.

SIR,

We have the honour to submit this second interim report of the activities of the Pig Industry Council.

The need for the existence of such a body was emphasized in the "Report on the Marketing of Pigs in England and Wales" (Economic Series No. 12), issued by the Ministry of Agriculture and Fisheries, and the Council was constituted in May, 1928, shortly after the issue of a further report by the Ministry, entitled "Report on the Pork and Bacon Trades in England and Wales" (Economic Series No. 17).

These two official reports to a large extent paved the way for the Council's investigations by accumulating relevant facts and figures in a convenient and accessible form.

The Council's terms of reference as laid down by the Minister are as follows :—

“ To consider the circumstances affecting pig production in England and Wales, with special reference to methods of marketing and to the requirements of the home market, and to make recommendations from time to time with the object of increasing the home production both of pork and bacon.”

The questions with which the Council has been confronted have therefore been to discover whether the industry is profitable to-day, whether it is capable of expansion, whether it can remain static without losing ground actually as well as relatively to imports, and, finally, to what extent its future is within its own control or is at the mercy of others.

We have reached certain conclusions on these points and have been gratified to observe, in the recently published Report of the Imperial Economic Committee on Pigs and Pig Products, recommendations in many cases similar to those that we make here.

The Council early decided that the most expeditious and practical way of achieving results would be to divide the field of investigation into various sections, appointing a special Committee from among its members to deal with each of them. The Committees thus appointed were five—viz., Breeding, Feeding, Swine Husbandry, Marketing and Veterinary Committees—to each of which programmes of work were allotted.

During the past 17 months, the Council and its constituent Committees have held over 50 meetings ; in addition, the Council, with the approval of the Ministry, has sent a deputation to study conditions on the Continent, and has, collectively or individually, made a number of visits of inspection in this country. During this period, the Council has collected a quantity of evidence and has also taken full advantage of the opportunity for a full interchange of opinion between the various sections of the industry represented on the Council.

The time is now considered ripe for this general statement of the Council's work.

It is desirable, at the outset, to state the following basic facts. On the average, our home output of pig-meat has remained practically stationary for the past 60 years, during which period the volume of imports has steadily increased. At present, we import nearly two-thirds of the pig-meat consumed in the United Kingdom. The declared value of the imports of pig-meat (excluding lard, of which the imports were valued at £7,506,412) in the year 1928 was no less than

£48,591,277, the principal sources of supply, in order of value, being :—

	£
Denmark	25,275,842
U.S.A.	6,171,638
Netherlands .. .	4,610,486
Irish Free State ..	4,305,733
Canada	1,946,013
Sweden	1,863,732

Granted the supply of feeding-stuffs, there would appear to be no technical, as distinct from economic, reason why Great Britain should not produce the whole of the pig-meat she now imports. The question, as we shall show later, is entirely one of the profitability of the business.

Turning now to an analysis of the pig-meat market, the chief forms in which supplies are demanded are : (a) Wiltshire-cut bacon, (b) Midland-cut bacon, (c) Fresh pork, (d) Hams. Of these four, the bacon demand—and, particularly, that for Wiltshire-cut sides—is of by far the greatest monetary importance. The pork and ham trades are nearly equal in monetary value.

It was estimated in 1925 that English pig producers directed their output to the pork and bacon markets in about equal proportions. Of these alternative markets, that for pork is filled by home and Irish supplies, reinforced by some 10,000 tons (gross—i.e., including subsequent re-exports) of frozen pork, chiefly from New Zealand, the United States and the Argentine. The pork market, which consumes about one-fifth of our total supplies of pig-meat, is capable of but small expansion, and that only at the expense of other fresh meats.

The bacon market, on the other hand, has been and is exposed to the concentrated attacks of exporting countries, the total declared value of gross imports of bacon into this country in 1928 being £40½ million, of which probably £36½ million consisted of mild-cured Wiltshire-cut bacon. In 1928, the declared value of bacon imports from Denmark, Sweden and Holland was £31½ million—i.e., about 80 per cent. of the total gross imports.* Bacon from these countries is tank-cured, and is of a quality and price that appears to satisfy consumers in this country. Emphasis must be laid on the fact that Denmark and Sweden concentrate bacon production entirely on this one objective, and have no other market. Their whole organization for production, curing and distribution is designed with the single aim of supplying the British market with

* For the sake of simplicity, bacon from other sources can be disregarded.

bacon of one type and quality. Holland, on the other hand, has wider markets, export and domestic, for pork of various weights. It is clear, however, that expansion of our production of pig-meats can only be at the expense of imports of these mild-cured Wiltshire-cut sides—in other words, this expansion involves the invasion of a market in which there is already very strong competition.

At this stage, the Council desires to place before the Minister a brief statement of its more important findings in the fields of production and marketing respectively. These statements reveal certain weaknesses in the industry and give some indication of what can be done by the industry itself to meet this competition. It should be explained that much of the work of certain of the Council's Committees has been on points of detail (for instance, the Ministry consulted the Feeding Committee on the terms of a leaflet dealing with fish meal), but we are omitting reference to these details in order not to confuse the major issues.

1. PRODUCTION

(a) *General*.—The Council has had evidence indicating a high standard of prolificacy, growth-rate and immunity from certain diseases (i.e., those not notifiable in this country) in Denmark, Holland and Sweden, but has not yet obtained satisfactory data upon which to decide how far this is due to careful and realistic selection, and how far to scientific feeding and veterinary treatment.

(b) *Breeding*.—The possession of a large number of breeds, however good, increases the difficulties in obtaining standardization of type, and the first step towards an improvement in the English pig industry must be an attempt either to bring up all the breeds to a first-class commercial standard, or to reduce the number of breeds used and to concentrate upon strains of proven efficiency. The supreme importance of "pedigree of performance" is insufficiently understood in this country. While the important part played by the pedigree breeder is recognized, it must be pointed out that care should be taken to avoid attaching too much weight to points unrelated to commercial realities, and greater attention should be given to such factors as prolificacy and potential performance of offspring. The Council has therefore made certain recommendations and suggestions in connexion with this point, the most important of which is a recommendation that all farmers should use the fine-boned type of Large White boar as sire for the production of commercial pigs. The Council is glad to learn that the Ministry is giving wide publicity to these recommendations in Marketing Leaflet No. 15. It is obvious that improvements in other directions could only be of limited value to the industry so long as the methods of breeding and production remain defective. So far, therefore, the Council has devoted more attention to breeding and production than to other aspects of its work, and it considers that the most important of the recommendations which it has so far been able to formulate arise under this heading.

(c) *Efficiency Measure.*—Lack of success in pig-keeping, in so far as it may be due to factors within the producers' control, may be attributable to mismanagement by the breeder or feeder, unsuitable stock, or unsuitable conditions under which he operates. Recording and litter-testing and the existence of recognized breeding centres would supply a means of measuring the efficiency of the individual breeder or feeder or, of his stock, and recommendations have already been made by the Council with this object in view. These have also been published by the Ministry in Marketing Leaflet No. 15, and, at the request of the Ministry, the Council is now considering them further in detail.

(d) *Feeding and Management.*—The deputation of the Council which recently visited the Continent found there a more widespread knowledge of the technique of feeding and management than there is in this country. This should not be difficult to remedy. Proper housing, warmth and skilled management obviously have an important bearing on production costs, and it appears possible that in these matters we have not kept abreast of the times.

(e) *Health.*—There is no doubt that our losses from disease are heavier than the industry can afford, or need bear, and the whole field of veterinary research and administration requires, and is receiving by the Council, careful investigation both as to the amount and the co-ordination of the expenditure required on administration and research. It is hoped that the Council's Veterinary Committee will shortly be able to formulate definite proposals in this connexion.

There is little doubt that expenditure on both veterinary research and administration is generally below that of competing countries and does not comply with the requirements of modern animal husbandry.

(f) *Regularity of Production.*—The first requirement of a prosperous bacon industry is that its raw material shall be produced in adequate and regular quantities. In this country it is not. Only the farmer who regards pig-feeding as a regular part of his farming system can help to build up the industry; the in-and-out feeder adds to the many uncertainties from which it suffers. The difficulty would probably be solved naturally if the prices of pigs for bacon and pork were more stable. In addition, it should be observed that the regularity of output in Scandinavia—as compared with this country—is largely due to the fact that production there is directed almost exclusively towards the bacon market, and that the existence of alternative markets here—although it has some compensating advantages—severely militates against the regularity that is, on general grounds, desirable.

2. MARKETING

(a) *General.*—It is worthy of note that, in competing European countries, the bacon factories are more evenly distributed than is the case here.

(b) *Grading of Pigs.*—The difficulty of defining grades of live pigs and of relating these to carcass grades is well known, but the value attaching to National grade standards is considerable. The Ministry, with the approval of the trade, has demonstrated weight categories, which have aroused no adverse comments.

(c) *Assembly and Sale of Pigs.*—The bacon factory, the wholesale pork market and the retail pork shop are the destinations of live pigs, but it is doubtful whether they arrive there, generally, either by the most direct or by the most economical route. There is an

enormous annual charge on the industry, which is non-essential to the true cost of production, in the form of expenses incurred in auction markets and of profits, commissions or salaries payable to dealers, or agents or employees of bacon factories.

Very little information is available in this country as to the economy of assembling live pigs for sale in graded lots. The opinion has been expressed by the Food Manufacturers' Federation and by the National Federation of Meat Traders' Associations :—

(i) that it would be advantageous to be able to obtain trade requirements of pigs of stated weights ;

(ii) that there is room for economy in the present system of buying and transporting pigs ; and,

(iii) that a system of assembling and grading stations in surplus-producing areas would contribute to the solution of these problems.

On the other hand, the Marketing Committee of the Council has reported that, so long as total supplies remain short, it would be inopportune to attempt to relate these supplies to specific bacon factories. A special Committee of the Council is, however, considering the desirability of an experiment to demonstrate the practicability of (iii) above.

It is commonly believed that differences in quality are recognized at auction sales to a greater extent than is the case with other methods of sale, but this method has corresponding disadvantages. The farmer has many alternative methods of sale of which it is probably true that each could be improved by organization.

The Council is of opinion that improvement might be secured at an early date on two matters, namely, the introduction of a common unit of weight, and the question of the sale of pigs at auction by live weight. On the first of these points, the Council has already recommended the adoption of the score (20 lb.), but on the second it has not yet completed certain inquiries in conjunction with the National Farmers' Union.

(d) *Type of Factory Cure.*—Imports of Wiltshire-style bacon, with the exception of Irish, are mostly tank-cured, this process occupying from seven to nine days. Bacon cured by this process appears to satisfy the present-day taste. The dry process in general use in this country is capable of producing bacon of superior quality, but the process takes, on an average, three weeks and is necessarily more costly. The English curers who use the dry cure claim that their method gives a lower percentage of water content and that their product is therefore of higher food value, weight for weight, than the tank-cured article.

(e) *Factory Capacity and Supplies.*—The Council has evidence that supplies of pigs to seven representative factories in this country in 1928 were, on an average, only 55 per cent. of the capacity of the factories throughout the year ; moreover, they are variable in quantity from week to week and in quality at all times.

No clear evidence has been obtained as to what would be the effect on overhead charges if factories were kept regularly and fully supplied with pigs, but it is generally admitted that the quality of the pig supplies would improve if quality were recognized in price, but this must remain a matter of difficulty so long as supplies are short.

(f) *Grading and Marking of English Bacon.*—The Council has not yet investigated the difficult problem of devising workable grade standards for English bacon with a view to the application

of the National Mark, but inclines to the view that such a course would be advantageous if the practical difficulties can be overcome.

(g) *Misrepresentation of Imported Supplies.*—We are informed that evidence is obtainable of the prevalence of misrepresentation of imported bacon and hams as English, and we consider that, if the evidence warrants it, application should be made by the proper organizations to the Standing Joint Committee under the Merchandise Marks Act for an Order requiring the marking of imported bacon and hams.

The question now arises whether, in the event of the industry taking such action as it can in these directions, there is any substantial ground for anticipating a gradual development in contrast to the stagnation of the past half-century. The answer is bound up with the relation of costs to profits. The Feeding Committee of the Council estimates that a price of 16s. 0d. a score is necessary to show a reasonable profit to the producers of a bacon pig of 160 lb. dead-weight when barley meal costs 10s. 6d. a cwt., although, owing to the low prices at which bacon is frequently imported, it does not necessarily follow that the bacon curers can pay this price. We have related this theoretical figure to monthly average prices for bacon pigs during the last five years, and have formed the opinion that only the regular pig feeder, conducting his business on the most economical lines, had any hope of coming through with a profit. So much for the immediate past. In regard to the future, and assuming the accuracy of the figure given above, it would seem that an improved economic environment must be secured as a condition precedent to development. This improvement can only be obtained by (a) reducing the costs of production, marketing and manufacture, or (b) maintaining price artificially.

We do not doubt that some economies can be achieved in production, marketing and manufacture, but, at the present stage of our investigation, we are unable to say whether they would ever be on such a scale as to put the industry at a distinct advantage compared with European competitors.

We therefore arrive at the fundamental question of whether the Government desires to see an *immediate* expansion of the pig industry of this country. We can see certain definite advantages in such an expansion, both from the standpoint of the nation in general and of the agricultural industry in particular.

In the first place, there would be the improvement of the land. It has been calculated that the residual manurial value of the foodstuffs consumed by a pig during the first six months of its life amounts to no less than 9s. Consequently, should an increase in pig population which is within the range of practical possibility

be achieved, the manurial value of the land would be increased by sums ranging up to £4 million per annum, and this, of course, would be of great benefit to agricultural production generally. In addition, account must be taken of the value of the inedible offals which would be available for use both as fertilizers and stock foods in respect of every pig raised and slaughtered in this country.

In the second place, there is the demand for labour which such a change would necessitate. On the extreme hypothesis that all the pig products now imported were produced in this country—in which case the number of sows kept would be raised by about 800,000—it is estimated that regular employment would be provided for about 68,000 men, of whom 48,000 would be engaged in work on the farm and 20,000 in factories, transport and accessory services. Such an increase in rural employment would entail a large increase, probably amounting to about 200,000, in the rural population of this country. In view of the grave national dangers to which the predominantly urban distribution of our people is liable to expose us, an increase in rural population is desirable.

In the third place, approximately 3,500,000 tons of pig meals and nuts would be required per annum to support the increased pig population that we have assumed. It is estimated that the services connected with the provision of this additional quantity of foodstuffs would, if the meals and nuts were used in about equal proportions, afford employment for a further 10,000 men. It is, moreover, worth remarking that these meals and nuts would contain 1,500,000 tons of millers' offals, and that to produce this quantity of offals 6,000,000 tons of wheat would be needed. Such an increased internal demand for millers' offals might in time be expected to lead to a considerable increase in the quantity of wheat milled at home, thereby creating another field for additional employment.

It would be of great importance to ascertain whether other markets would be available for Scandinavian products in the event of the expansion, at their expense, of our home output of mild-cured bacon, or whether sheer economic necessity would compel these countries either to change their whole agricultural system or to engage in a severe price war with the revived pig industry of this country. The last of these contingencies appears the most likely, and it would be essential that during the transitional phase a reasonable margin of profit should be obtainable by English producers until the revival of the English industry became real and lasting. During this hypothetical period, therefore, the Council is of opinion that direct assistance from the Government would in all probability be necessary.

Whether such assistance should take the form of a bonus on the production of the proper type of bacon pig, or be brought about by a limitation or rationing of imports or by the operations of an Import Board, the Council does not feel it is the right body to decide. Should, however, the Government consider it to be in the national interests to take active steps

to foster the home pig industry and stimulate it into prompt and effective development, the Council would urge that a Committee be appointed to advise upon the matter, and that this body should not consist, as does the present Council, of members all of whom are interested in the production or marketing of pigs and pig products, but of persons able to take an entirely detached view of the problem.

We have the honour to be, Sir,

Your obedient Servants,

ERNEST R. DEBENHAM, *Chairman.*

FOLKESTONE, *Vice-Chairman.*

THOMAS BAXTER.

DAVID BLACK.

J. F. BODINNAR.

DARESURY.

H. GERMAN.

JOHN H. GLOVER.

FREDERICK KEEBLE.

H. MARTIN LEWIS.

A. E. MARSH.

H. W. G. MILLMAN.

LEOPOLD C. PAGET.

PHILLIMORE.

J. B. PITCHFORD.

F. S. KENNEDY SHAW.

THEO. A. STEPHENS.

WILLIAM WRIGHT.

J. B. BABER, *Secretary.*

December 5, 1929.

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THE COMPOSITION OF SOME RABBIT CARCASSES

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Introduction.—The increasing importance of rabbit flesh, of which the imports into the United Kingdom during 1926 amounted to 266,712 tons, of a declared value of £768,859, is receiving greater attention than at any previous period, with the possible exception of the war years, owing to the annual increase in British rabbit husbandry for the combined production of pelts and flesh. The flesh produced by domesticated rabbits is gradually being incorporated within a greater variety of menus and commands a ready market in densely populated areas. During recent years, claims have been made that rabbit meat is similar in composition to that of chicken. Investigations at the National Institute of Poultry Husbandry were designed to inquire into the composition of rabbit carcasses, and the following brief summary of this work* shows the weights of different parts of the body, depreciation of weight during the dressing processes, and the chemical composition of the edible meat.

Material.—The rabbits employed in this experiment consisted of 24 white Angoras (albinos), divided into two equal groups, (1) designated "Young," each approximately 11 months old, and (2) "Adults," aged 24 months or slightly over. The two groups each contained equal numbers of bucks and does. Thus material was provided for a comparison of the composition of rabbit flesh in males and females, as well as of "Young" and "Adults." Each of the "Adult" does had reared one litter, but none of the other rabbits had been used for breeding purposes.

The system of feeding and general management employed during the life of these rabbits were of a normal kind.† The animals were slaughtered in pairs in an effort to provide males and females of similar live weight.

Methods.—The rabbits were slaughtered and certain parts of the carcasses weighed separately during the dressing process.

* "Studies of the Composition of Some Rabbit Carcasses": W. King Wilson, Rabbit Department, National Institute of Poultry Husbandry; and S. Morris, Chemistry Department, Harper Adams Agricultural College (in preparation).

† See "Rabbit Growth Studies under Commercial Conditions": W. King Wilson. *The Harper Adams Utility Poultry Journal*, Vol. xiii, No. 11, 1928.

Shoulders and hindquarters comprised the normal cuts for these, such as the trade butchers cut from the carcasses. The trunk included liver, kidneys, heart, and lungs. Weights for bones were recorded after removal of all available flesh and they had been allowed to dry. Skin weights include the ears and furred pelt as it is normally removed.

TABLE 1.—SOME WEIGHTS OF BODY PARTS

	" Young "		" Adults "	
	Does	Bucks	Does	Bucks
	lb. oz.	lb. oz.	lb. oz.	lb. oz.
Live weight	4 9-25	4 8-75	4 10-30	4 9-70
Dressed „	2 12-62	2 10-42	3 1-83	2 14-08
Skin „	7-58	9-08	8-25	8-92
Weight of two shoulders ..	5-92	5-67	6-38	6-13
„ „ two hindquarters ..	10-25	9-42	10-33	9-71
„ „ trunk	1 5-29	1 4-33	1 8-50	1 6-25
„ „ liver	2-68	3-12	2-00	2-46
„ „ kidneys, lungs and heart	1-08	1-21	1-13	1-13
„ „ dry bones	4-29	4-13	5-29	5-00

Dressing Data.—In Table 1, the average weights for "Young" and "Adults" are sexually divided. Comparison of the live and dressed weights reveal greater weight depreciation for males than for females in both the "Young" and "Adult" groups, the loss amounting to 31 oz. in "Young" bucks and 28 oz. in the group of "Adult" bucks compared with 28 oz. and 24 oz. respectively for the "Young" and "Adult" doe groups. As the rabbits increase in age a corresponding increase in weight of dressed carcass coincides with the decrease in moisture content. It is also interesting to note that the average skin weight is lower in females than males of similar age. The texture of the skin was observed to be soft and velvet-like to the touch in the case of females, whilst in males the skin was thicker, suggesting greater strength, having a general leather-like feeling when handled.

Composition of Rabbit Flesh.—In Table 2, the average percentages of moisture, protein, fat, carbohydrate and total ash are set forth for the separate sexes of both age groups. From these figures it will be seen that the fat content of females is conspicuously higher than that for males of similar age, in both groups. In the "Young" group there is a difference of 4 per cent., and in the "Adult" group a difference of

TABLE 2.—CHEMICAL COMPOSITION OF FLESH

	" Young "		" Adults "	
	Does	Bucks	Does	Bucks
	Per cent.	Per cent.	Per cent.	Per cent.
Water	67.30	69.68	62.98	66.93
Protein	20.27	21.11	19.96	21.88
Fat	5.80	1.74	9.12	3.29
Carbohydrates ..	5.21	5.96	6.68	6.57
Ash	1.42	1.55	1.27	1.33

6 per cent. To balance this, the does contain less moisture and slightly less protein than the bucks.

The data contained in Table 2 show that the composition of rabbit flesh compares favourably with that of chicken. The United States Department of Agriculture Bulletin 1090 gives the average composition of edible chicken as 74.8 per cent. moisture, 21.5 per cent. protein, 2.5 per cent. fat, and 1.1 per cent. ash. In the analyses of the edible rabbit fleshes, Mr. Morris, who undertook the analytical work, arrived at the carbohydrate content by difference. It will be seen from the above figures that there is little (less than 1 per cent.) difference between the average protein content of the edible flesh of chickens and of rabbits. Since this protein is an important agent in price determination of such foodstuffs it is worthy of particular stress.

Detailed analyses of the ash composition of specimens of both sexes did not reveal conspicuous variation between females and males, the averages being respectively : calcium 3.94 and 4.06, potash 29.66 and 29.39, phosphoric acid 64.45 and 64.28, and chlorine 1.39 and 1.74.

During the dressing of these carcasses from albino rabbits, the colour of the fat was observed and recorded. Of the 24, 15 had distinctly yellow coloured fat, 8 had white fat, and the other one was doubtful. Subsequently, in the ether extract, all cases appeared as yellows. Work on fat coloration is being continued by Mr. Morris.

Summary.—The main points derived from this investigation are :—

1. Carcass weight depreciates more heavily in male than female rabbits of similar age.

2. The composition of male and female rabbit fleashes was noticeably different.

3. The main difference was in the fat composition, females containing 4 and 6 per cent. more than males in the "Young" and "Adult" groups respectively.

4. The chemical composition of edible rabbit meat closely resembles that of chicken, there being less than 1 per cent. difference in the average protein content of the two kinds of flesh.

* * * * *

MARCH ON THE FARM

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Milk Production.—Dairy farmers have so far suffered less from the depression than have wheat growers and winter cattle feeders. The January index figures of 167, 130 and 138 for milk, wheat and beef respectively would seem to explain the financial advantage of dairying, and generally the milk producer has known for some months ahead the price he would receive for his produce. This apparent advantage is undoubtedly largely due to collective bargaining as well as to the fact that liquid milk is naturally protected from foreign competition. Unfortunately the figure 167 does not indicate the fact that supplies of liquid milk are purchasable at prices much below the contract terms represented by the index; many farmers were unable to secure the suggested contract terms, and others have been unable to market the quantity they desired to produce.

The existence of surplus milk in winter threatens to prejudice the interests of all dairy farmers. Many farmers attribute the winter surplus problem to the change from spring to autumn contract time, and to contract conditions which limit the increase in quantity permitted in the summer months; the summer-producer complains that he is compelled to maintain a winter output in order to ensure a market for his main supply, which is in summer. Others criticize the modern tendency to aim at high average yields and the heavy feeding of concentrated foods. Of one cause there is no doubt, viz., the increased number of dairy cows,

even allowing for the reductions of the past two years ; but there is also good reason to believe that the motor lorry has facilitated the marketing of much milk that would otherwise be devoted to rearing and manufacturing purposes.

Three courses suggest themselves for the preservation of the dairy farmers' interests : increased consumption of liquid milk, organized utilization of surplus, and readjustments in the matter of production. The case for increased consumption is an excellent one, and full support should be given to the proposals which are to be put forward in connexion with the next contract conditions. A scheme for organized disposal of surplus milk was put forward last summer, but failed to secure sufficient support : it should be revived, amended if necessary and put into operation. As regards the necessary readjustments within the circle of production, this entails reconsideration by those farmers who have concentrated on milk production, with a view to their devoting some attention to breeding and rearing a larger part of the number of heifers required to maintain their herds. Sheep might also occupy a place of greater importance on the grassland and dairy farm, as they did in former years.

Breeding or Buying.—The tendency to rely on bought cows and heifers has been very noticeable in some districts during recent years. One county has become almost wholly dependent on Irish imports for the upkeep of its very heavy head of dairy cattle. The arguments in favour of this system are that it enables the farm to carry 50 per cent. more cows in milk, enables the farmer to maintain a more uniform output, cuts out the losses and disappointments associated with the introduction of home-bred heifers that prove bad milkers, and lastly that it costs more to rear a good milker—allowing for the loss on the failures—than to buy one. Against this system may be urged the argument as to over-production as set forth in the preceding paragraph. Bought cows and heifers are not invariably a success or free from disease, and the increased returns from the greater sale of milk and fat cattle are seriously reduced by the total sums expended in purchased cattle and by the increased bill for feeding stuffs. The purchase system is favoured by dear milk, cheap cows and dear beef, conditions which are mutually destructive. Any evaluation of the respective financial returns from the buying and the breeding systems is entirely dependent on milk yields and the difference between buying in and selling out prices of cows.

In practice the result turns largely on the milking qualities of the home-bred heifers, and it may be admitted that unless the farmer can breed heifers that are mainly—not as the exception—reliable milkers, he can at present make a better profit by purchasing cows and heifers in milk. Much therefore depends on the type of animal which the farmer succeeds in breeding, and on the dairy inheritance of the bull used. Certainty of dairy inheritance can be reasonably expected only when systematic breeding is pursued, and this seems generally to involve some measure of relationship (it may be remote) between the animals mated.

Type of Cow.—The writer's conclusions in favour of the specialized milk-producing type were indicated in these notes in February, 1925, since when the evidence has been amplified by the large number of cows which, under improved management, have given very large yields of milk whilst maintaining their health and breeding properties. On the other hand, evidence has been accumulating that the specialized animal is the more to be relied upon to breed heifers worthy of retention in the dairy. The dairy farmer, therefore, should be chary of attempting to build up a home-bred herd of high producers by endeavouring to combine heavy milking capacity with a type of conformation characteristic of beef cattle.

While there are individual animals that seem to combine the two objects of milk and beef qualities, it cannot be denied that optimum production in either direction is usually associated with a particular type of conformation. Disappointment follows when too much emphasis is laid on beef points in the choice of the dairy bull. The dairy cow requires, beside well developed mammary organs, a frame and conformation that is calculated to support her milking and breeding properties: she must have ample digestive capacity, and in view of the recently recognized importance of the skeleton as a reserve of mineral matter, a more kindly view must be taken of the rugged frame containing more bone than is acceptable to the judge of the butcher's beast.

Other Live Stock.—The comparative economy of the various kinds of live stock food converters may be summarized as follows: In the fattening bullock 10 lb. of starch equivalent costing 13d. produce 1 lb. of meat worth about 9d.; in the sheep the 1 lb. of meat so made is worth about 14d. At the

moment the pig greatly excels by producing 1 lb. of meat worth 12d. from 4 lb. of starch equivalent (about 5½ lb. of meal) costing 6d. The moderate yielding dairy cow produces 1 gallon of milk worth 10d. to 16d. from 6 lb. of starch equivalent costing 8d. Lastly, the laying hen, producing a dozen eggs worth from 12d. to 30d. on about 9 lb. of meal costing less than 12d., is one of the most profitable units of the series, though obviously she is most remunerative when so managed that she lays when the prices are above the average line.

[NOTE.—*The Ministry desires to express its cordial appreciation of Mr. J. R. Bond's valued services as the writer of these monthly notes "On the Farm" during the past six years. With the present issue, Mr. Bond relinquishes the conduct of this feature of this JOURNAL, which from the next (April) issue onwards will be contributed by Mr. William Lawson, M.B.E., N.D.A., N.D.D., Director of Agriculture for West Sussex.*]

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NOTES ON MANURES

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Rothamsted Experimental Station.

Top-dressing Wheat.—It has frequently been proved that under the ordinary conditions of rotation farming the chief need of wheat, as far as manures are concerned, is a supply of available nitrogen. Since this is usually reserved for a spring top dressing, the need can be fairly accurately gauged by the appearance of the plant at this time of year, a pale stunted growth accompanied by poor tillering being a sign that the soil has been impoverished of nitrates either by the washing of the winter rains, or by exhaustion through previous cropping. Under such conditions the application of a top dressing of 1 cwt. per acre of sulphate of ammonia, nitrate of soda, or one of the various other forms of quick-acting nitrogen has a marked effect in improving the colour and growth rate of the plant, and commonly yields about an extra sack of corn per acre and an equivalent amount of straw. Usually the quantity of nitrogen given is about as stated above. It

is less in wet districts and on soils in high condition, and it may be increased in areas of low rainfall and on poor soils, especially if the nitrogen is assisted by phosphate and potash where necessary. On the Rothamsted farm 2 cwt. of sulphate of ammonia has seldom given certain increases above the level attained by 1 cwt. It is sometimes found, however, that applications of sulphate of ammonia somewhat in excess of 1 cwt. per acre are well utilized by wheat. Thus an extensive series of experiments has recently been published from München in Germany in which increasing doses of sulphate of ammonia were used on a number of varieties of wheat. The nitrogen was supported by an autumn application of about 4 cwt. of basic slag and $1\frac{1}{2}$ cwt. of muriate of potash. Each treatment was set out three times on every variety, and the experiments were repeated for a series of years. Sulphate of ammonia was top-dressed in spring at six rates of application, ranging from nothing to $3\frac{3}{4}$ cwt. per acre. Taking all varieties together, and averaging the results of five consecutive years, the figures in English units were :—

Sulphate of ammonia lb. per acre	Nitrogen lb. per acre	Yield per acre average 1924-8		Successive increases		Proportion of grain to 100 parts straw
		Grain Bush.	Straw Cwt.	Bush.	Cwt.	
None ..	0	33.7	33.0	—	—	56
112 ..	22.5	41.6	45.0	7.9	12	51
180 ..	36.0	46.0	51.0	4.4	6	50
247 ..	49.5	48.5	57.2	2.5	6.2	47
315 ..	63.0	50.8	62.7	2.3	5.3	44
382 ..	76.5	53.3	67.1	2.5	4.4	44

In these experiments the utilization of the first 1 cwt. of sulphate of ammonia was extremely good. The addition of a further $\frac{3}{4}$ th cwt. brought a further handsome increase, after which the returns became somewhat more problematical in view of the danger of lodging the crops. It will be seen that the nitrogen tends to increase the straw to a greater extent than the grain. It was observed that the attacks of yellow rust were more pronounced where heavy doses of nitrogen had been given. Some varieties were capable of utilizing generous manurial treatment better than others, a point which is also being examined in this country.

Nitrogen for Oats.—Winter oats may be regarded in the same way as wheat as far as nitrogenous top-dressings are

concerned. At Rothamsted, however, the use of 2 cwt. per acre of sulphate of ammonia has occasionally given profitable increases. Similar experiments on varieties of spring oats to those reported on wheat above have also been recently carried out in Germany. The plan was in all essentials the same as with wheat except that the whole dressing, sulphate of ammonia and minerals alike, were applied before sowing. The oats, like the wheat, responded excellently to the first 1 cwt. of sulphate of ammonia, and there was indication that as the nitrogen was increased the rate of increase in the grain was slightly better maintained than with the wheat. The figures for such experiments should be taken in detail, but a general view may be obtained by proceeding as with wheat. The results thus calculated in English units were :—

Sulphate of ammonia lb. per acre	Nitrogen lb. per acre	Yield per acre ave'age 1925-8		Successive increase		Proportion of grain to 100 parts straw
		Grain Bush.	Straw Cwt.	Bush.	Cwt.	
0 ..	0	38.0	26.3	—	—	55
112 ..	22.5	52.8	36.4	14.8	10.1	54
180 ..	36.0	59.0	42.4	6.2	6.0	52
247 ..	49.5	65.2	47.6	6.2	5.2	52 .
315 ..	63.0	69.8	52.5	4.6	4.9	50
382 ..	76.5	75.0	56.9	5.2	4.4	50

As with wheat, the first dressing was the most effective, but good results were obtained up to at least 2½ cwt. of sulphate of ammonia per acre. It was noticed that damage by frit fly was most marked on those plots receiving either no nitrogen or light dressings.

Time of Application.—The effect of varying the time of application of nitrogenous dressings, sulphate and muriate of ammonia in this case, is being examined at Rothamsted. The experiments have been conducted at two rates, 1 cwt. and 2 cwt. per acre; the times have been early in the spring, about mid-March as a rule, when tillering is active, and late in the season in mid-May when tillering has practically ended. The crops have been wheat and winter oats. The following table shows the increase or decrease in grain and straw produced by the late dressings in relation to the yields produced by the corresponding early dressings.

INCREASE (OR DECREASE) PER ACRE

	1 cwt. dressing		2 cwt. dressing	
	Grain bush.	Straw cwt.	Grain bush.	Straw cwt.
1921 Wheat ..	1.3	1.5	2.7	.2
1922 „ ..	1.4	0.9	-1.8	-1.8
1926 „ ..	3.6	-.2	-3.1	-3.4
1927 „ ..	-.2	-.6	-1.1	-6.5
1928 „ ..	2.7	2.3	—	—
1923 Oats ..	-2.7	-3.4	7.3	-1.8
1925 „ ..	4.9	-1.1	2.9	-2.2
1926 „ ..	1.7	-2.0	.4	-9.8

The data so far accumulated suggest that the single dose applied early increases the number of tillers, but does not, as a rule, give as much grain as the later dressing. The heavy dressing applied early does best on wheat, both in grain and straw. The light dose applied late gives good grain production on the tillers already formed by increasing the size of the ears. The heavy dose given late has not been on the whole as successful on wheat as the early dressing, although it has done well on oats; in every case it has given less straw. Where the land is in such a condition that the crop will stand a heavy dressing these experiments suggest that it should be applied early, in ordinary cases the light dressing may well be deferred until tillering is well advanced. There is, however, a risk with late dressings that, particularly in dry areas, the manure may remain unutilized until far in the season, and farmers claim that an early dressing tends to keep down weeds, by causing the corn to cover the ground early.

Lime for Lucerne.—One of the most important soil factors in the successful growing of lucerne is a sufficient supply of chalk. Not only is an acid reaction highly unfavourable to the plant itself, but it also reacts injuriously on the nodule organisms, which tend to die out on such soils. These points were well illustrated by a recent experiment laid down in 1926 on some very poor, light, acid land on the verge of cultivation in East Suffolk, a locality in which the lucerne nodule organisms are abundant on neutral soils, and where consequently inoculation would usually be unnecessary.

MEAN YIELD OF LUCERNE HAY. 1ST CUT 1928

		CWT. PER ACRE	
		Not inoculated	Inoculated
No lime (pH 5.4), very acid ..	..	4.5	7.5
Chalk, 5 tons per acre ..	..	14.3	20.3
„ 10 „ „ ..	..	9.5	19.8
„ 20 „ „ ..	..	13.0	24.7

In the absence of chalk the crop was a failure both with and without inoculation. All rates of application of chalk improved the crop slightly without inoculation, but when chalk was present inoculation produced a further appreciable increase.

Early Potatoes.—Suitable varieties, soil and climate are far more important than matters of manuring in the growth of early potatoes. Nevertheless, heavy all-round manuring is the rule in dealing with this crop, since everything must be made as favourable for rapid growth as possible. Moreover, in a normal season, the value of the produce justifies a heavy outlay on fertilizers. As far as the balance of the manure is concerned, the makers of compound fertilizers usually provide rather more nitrogen and less potash in early potato manures than those intended for main crops. In districts such as Jersey, where much seaweed is used, this view finds some support, the weed being much richer in potash and slightly poorer in nitrogen than ordinary farmyard manure. Under ordinary conditions the tendency has been to grade up the early potato manures in potash. Thus, on the silt soils in Lincolnshire, J. C. Wallace has obtained better results with mixtures containing from 7.5 to 12.5 per cent. of potash than with compounds providing from 2 to 4 per cent. The effect of fertilizers on early potatoes has been examined in several important districts. Experiments carried out in Jersey over a number of years bring out the following points. The need for generous treatment, about 15 cwt. per acre of mixed artificials being commonly applied in addition to dung or seaweed. These organic manures reduce the need for potash and increase the requirement of phosphate, of which the mixtures usually contain about 20 per cent., *i.e.*, 9 per cent. phosphoric acid. Phosphate has value in hastening the crop, but, unless balanced by suitable quantities of nitrogen and potash, it may have little effect or even tend to depress the yield in certain cases. Potash prolongs the growing period and increases the crop. The sulphate is preferred for the stiffer soils, although the chloride may be used on the lighter types. Nitrogen also prolongs growth; the greater part is supplied as sulphate of ammonia, but it is claimed that better results are obtained by including some nitrate of soda, as this provides nitrogen for the earliest period of growth. The nitrate is frequently applied a month after planting. Where no dung or seaweed is used it is not unusual to apply part of the nitrogen in the organic form as castor meal or fish

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended February 12.				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	10 2d	10 2d	10 2d	10 2d	13 0
Nitro-chalk (N. 15½%) ..	9 19d	9 19d	9 19d	9 19d	12 10
Sulphate of ammonia :—					
Neutral (N. 20·6%) ..	10 2d	10 2d	10 2d	10 2d	9 10
Calcium cyanamide (N. 20·6%))	9 4e	9 4e	9 4e	9 4e	8 11
Kainit (Pot. 14%) ..	3 0	2 19	2 19	3 3	4 6
Potash salts (Pot. 30%) ..	5 3	4 18	5 0	4 19	3 4
" (Pot. 20%) ..	3 15	3 9	3 8	3 11	3 7
Muriate of potash (Pot. 50%)	9 17	9 3	9 2	9 5	3 8
Sulphate,, (Pot. 48%)	11 19	11 6	11 5	11 5	4 8
Basic Slag (P.A. 15½%)||	2 13c	2 3c	..	2 9c	3 1
" (P.A. 14%)||	2 7c	1 16c	1 16c	2 3c	3 2
" (P.A. 11%)||	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 28-27½%)||	2 2a	2 10a	2 5a	2 2a	1 7
Superphosphate (S.P.A. 16%)..	3 11	..	3 9	3 6	4 2
" (S.P.A. 13½%)..	3 5	2 18	3 3	3 0	4 4
Bone meal (N. 3½%, P.A. 20½%)	8 15	8 10	8 12	7 15	..
Steamed bone flour (N. ½%, P.A. 27½-29½%) ..	5 17b	..	6 10	4 17	..
Burnt Lump Lime ..	1 8k	1 10l	1 11n	2 2m	..
Ground Lime ..	1 12k	..	..	1 17m	..
" Limestone ..	1 3k	..	1 8n	2 6m	..
" Chalk ..	..	1 6	..	1 11m	..
Slaked Lime ..	..	..	2 12n	3 2m	..

Abbreviations: N.—Nitrogen; P.A.—Phosphoric Acid; S.P.A.—Soluble Phosphoric Acid; Pot.—Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‡ Fineness 80% through standard sieve. α Prices for 6-ton lots f.o.r. at makers' works.

§ Delivered (within a limited area) at purchaser's nearest railway station.

¶ Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

|| For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

|| Delivered in 4-ton lots at purchaser's nearest railway station.

|| 6-ton lots f.o.r. Bristol: ground limestone 98·95% through standard sieve.

! F.o.r. Knottingley.

m 6-ton lots delivered London district, ground limestone 65% through standard sieve. Ground limestone, ground chalk and slaked lime in non-returnable bags.

n 6-ton lots delivered Liverpool stations, ground limestone 45% through standard sieve. Ground limestone and slaked lime in non-returnable bags.

manure. At Kirton, in Lincolnshire, the tendency has been to reduce the proportion of superphosphate, and to increase the nitrogen and in particular the potash. Thus successful dressings have been (*see Kirton Extension Leaflet, No. 5*):—

	High Phosphate	Low Phosphate
Nitrogen per cent.	6.1	8.1
Soluble phosphoric acid per cent.	6.8	4.6
Potash per cent.	9.3	12.5
Dressing per acre, cwt.	12.0	10.0

The ordinary compounds contain about 5.4 per cent. nitrogen, 10 per cent. soluble phosphoric acid, and 1.5 per cent. potash. Dung is not used every year, and is regarded more as a means of bringing the artificials into full use rather than as a substitute for part of the dressing.

* * * * *

NOTES ON FEEDING STUFFS

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The Digestive Tracts of Farm Animals.—All of the higher animals are built on the same general plan: thus we can study the organs of a rabbit and of a horse or cow (or even man) and we shall find the same systems, playing similar rôles, in each case. This fact is extremely helpful, and allows a general scheme of the working of the animal body to be drawn up, which applies to all common species—in fact it makes of physiology a science rather than a large number of isolated facts. A little knowledge of this subject gives the impression that details of physiology can be ascertained with convenient and cheap little animals like rabbits and rats, and that the results can be generalized broadly over all animals, and applied as guides to the care and feeding of horses, cattle, etc. In general, this will eventually prove to be justified where the broad principles are concerned, but experience teaches that such results should be thoroughly checked with each type of animal before they are incorporated into farming practice. Although the general plan is the same in all cases, each one has its own peculiar modifications, and these modifications are often found to be of fundamental importance in practice; the mechanisms involved in reproduction are similar in the cow and in the mare, but comparatively minor details, such as the length of time on heat, render the problem of improving fertility very different in the two cases. In the same way each

animal has its own peculiarities in its digestive tract, and these must be taken into consideration if the best use is to be made of it.

Among farm animals the cow and the sheep (also the goat) are ruminants : these have four stomachs instead of one, the result of which is that they can swallow food at a great rate, bring it back to the mouth again later, and chew it thoroughly at leisure. It can easily be realized how useful this property was to these animals in the wild state, when they were liable to be harassed by their predatory enemies. Roughly speaking, the first two stomachs, between which there is free communication, are for storage, the third is a kind of filter, which grinds the food material up and prevents any of it passing on until in a fine enough state of division, whilst the fourth is the true stomach producing digestive fluid and corresponding to the stomachs of non-ruminating animals. The approximate sizes of the four stomachs in cattle and sheep are as follows :—

		Cattle (litres)	Sheep (litres)
1st (Rumen)	} 140-200 {		13
2nd (Reticulum)			1
3rd (Omasum)		14-18	0.3
4th (Abomasum)		8-20	1.75

These figures show that the first stomach is very much the largest—about four times the capacity of the other three combined. In the sheep, the third stomach is relatively much smaller than in cattle, and this may be the reason why they are not so efficient in dealing with the coarsest types of fodder. The immense first stomach is not merely a store ; in it the food is being continually churned round, and, as there is much liquid present (the cow secretes some 60 litres of saliva a day, in addition to which the water drunk goes direct to the first two stomachs), it is reduced to a thoroughly soaked and finely-divided state. At the same time bacteria are active on it and break down the fibre, and this is the chief digestive process which goes on there. The mechanism by which material from the first stomach is brought back to the mouth has long been in dispute, but several American workers have studied it very carefully in the last few years, and have established the general plan on which this rather complicated act is based. By a series of contractions the pressure is lowered in the tube leading from the mouth to the stomach, and food material is sucked up from the latter. For this to be possible, two conditions are necessary—first, that the stomach should be fairly full, since the tube enters the stomach rather high up, and its end must obviously

be submerged, and secondly that there must be a large amount of liquid present. The importance of the latter can hardly be overstressed, for material can only be carried back to the mouth in a semi-liquid state, and any tendency to dryness will prevent rumination altogether. The cow's day, on the average, includes six hours eating and seven hours ruminating, leaving eleven hours during which the activities are limited to the continual maceration of the food in the first two stomachs, and its gradual transfer to the third as it gets into the right condition. Rumination is of great importance and requires a quiet period, for disturbance will cause it to stop, and if this occurs for long it is difficult to restart.

The four stomachs of the ruminant animal have been evolved to enable it to deal effectively with coarse, fibrous foods. In the young calf, which has only milk for its nourishment, the first three are very small, but within three or four weeks of birth they develop to a state where rumination is possible, and it is then that the calf can first feed on hay and other dry food. Fibrous foods fed to young stock help to develop the first three stomachs, and dairy heifers should have a moderate supply so that when their milking life begins they will have large compartments capable of dealing with large rations. This feeding of coarse fodders to young heifers, however, should not be carried too far or they will become paunchy, a state of affairs which is commonly attained in Denmark, but which is not looked on with favour in this country.

Although horses are not so good at digesting much coarse fodder as are cattle, they can, and do, deal with quite large quantities efficiently, and this in spite of the fact that they have only one, small, comparatively simple stomach. In their case, there is an enormous compartment further down the tract—the colon—which takes the place of the first three stomachs of cattle in the digestion of fibre. The capacities of the different parts of the tract in horses and cattle are approximately as follows :—

			Stomach	Intestines
Horse	..	..	31 pints	340 pints
Cattle	..	..	440 pints	183 pints

The stomachs of cattle are, then, nearly 15 times as large as those of horses, but their intestines are only half the size. Of the intestines of the horse a very large part consists of the huge colon, in which fibre digestion occurs (bacteria, etc.) ; this is the part which is seen when the stomach is cut open, and which appears to occupy nearly the whole cavity.

The stomach of the horse has other peculiarities apart from its smallness : the tube leading from the mouth narrows down very much just before it reaches the stomach (in cattle, on the other hand, it widens out), and this makes it very difficult for any material to return—the extreme rarity of vomiting in horses is well known. At the other end of the stomach, the intestine leading from it is U-shaped (the so-called syphon trap of the duodenum), and if fermentation lower down causes a lot of gas to appear, the pressure exerted squeezes this bent portion and closes it up. Thus the stomach of the horse may be completely shut up at either end, and this is the great digestive weakness of that species, often giving rise to discomfort and colic. The possibility of the complete shutting up of the stomach should be borne in mind, for if food material contained in it swells up great pain occurs, and the stomach may even rupture. To avoid this, steps should be taken to see that the swelling of food in the stomach takes place gradually, as happens when there is a plentiful supply of water in the stomach when it is eaten—in other words horses should always be watered before they are fed ; each mouthful of oats, etc., which is swallowed will then be soaked and will swell up directly on arrival, but if the horse is allowed to fill its stomach first and then to drink the swelling will render it over-full with the above-mentioned results. Many farmers are afraid of letting horses drink as much cold water as they want when they come in from work on a hot day, but although the writer has seen some hundreds treated in this way he has never yet seen one upset by it. The comparative weakness of the horse's stomach necessitates greater care in feeding them than in the case of ruminants. The horse feeder is relatively restricted in his choice of foods and he shows marked preference for a few special ones. Pre-eminent among these are oats and, to a less extent, bran, the fibre which they contain giving these an added value as "lighteners" of the food mass in the stomach—that is, as helping the rather poor digestive-capabilities of this part of the tract by enabling the juices thoroughly to permeate the substances to be digested.

The work of digestion is less in the meat-eating animals than in the herbivorous ones, because the transformations which have to be effected in the food are not so large, and consequently the digestive tract is not so complicated. The dog, for instance, has a very simple stomach and can even live without it, whilst the pig, which is intermediate between the plant and meat eating animals, has an intermediate stomach. It

has no facilities for dealing with coarse fodders, there being no compartment comparable to the first three stomachs of the ruminant or to the colon of the horse; this is the reason for that fact, well known in practice, that the pig should not be fed on fibrous foods.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	6 13
Maize	81	6.8	7 0
Decorticated ground nut cake	73	41.0	9 17
„ cotton cake	71	34.0	11 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1.71 shillings, and per unit protein equivalent, 2.54 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The “food values” which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	7 7
Oats	60	7.6	6 2
Barley	71	6.2	6 17
Potatoes	18	0.6	1 12
Swedes	7	0.7	0 14
Mangolds	7	0.4	0 13
Beans	66	20.0	8 4
Good meadow hay	37	4.6	3 15
Good oat straw	20	0.9	1 16
Good clover hay	38	7.0	4 3
Vetch and Oat silage	13	1.6	1 6
Barley Straw	23	0.7	2 1
Wheat straw	13	0.1	1 2
Bean straw	23	1.7	2 4

DESCRIPTION	Price per qr.		Price per ton	Manu-rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Protein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British..	—	—	9 10	0 12	8 18	72	2 6	1-34	9-6
Barley, British feeding	—	—	7 0	0 9	6 11	71	1 10	0-98	6-2
" American	24 6	400	6 17	0 9	6 8	71	1 10	0-98	6-2
" Danubian	24 6	"	6 17	0 9	6 8	71	1 10	0-98	6-2
" Persian	21 0	"	5 18*	0 9	5 9	71	1 6	0-80	6-2
" Syrian	25 0	"	7 0§	0 9	6 11	71	1 10	0-98	6-2
" Tunisian	24 0	"	6 15†	0 9	6 6	71	1 9	0-94	6-2
Oats, English, white	—	—	6 10	0 10	6 0	60	2 0	1-07	7-6
" " black and grey	—	—	7 0*	0 10	6 10	60	2 2	1-16	7-6
" Argentine	17 3	320	6 0	0 10	5 10	60	1 10	0-98	7-6
" Chilian	18 6	"	6 10	0 10	6 0	60	2 0	1-07	7-6
" German	19 0	"	6 13	0 10	6 3	60	2 1	1-12	7-6
Maize, Argentine	27 3	480	6 7	0 10	5 17	81	1 5	0-76	6-8
" South African	32 9	"	7 13§	0 10	7 3	81	1 9	0-94	6-8
Beans, English winter	—	—	8 15†	1 4	7 11	66	2 3	1-20	20
" Chinese	—	—	9 10§	1 4	8 6	66	2 6	1-34	20
Peas, English blue	—	—	9 0†	1 1	8 6	69	2 5	1-29	18
" Japanese	—	—	17 0§	1 1	15 19	69	4 7	2-45	18
Dari	—	—	8 10†	0 11	7 19	74	2 2	1-16	7-2
Milling offals—									
Bran, British..	—	—	5 15	1 1	4 14	42	2 3	1-20	10
" broad	—	—	6 15	1 1	5 14	42	2 9	1-47	10
Middlings, fine, imported	—	—	6 15	0 17	5 18	69	1 9	0-94	12
" coarse, British	—	—	5 15	0 17	4 18	58	1 8	0-89	11
Pollards, imported	—	—	5 5	1 1	4 4	60	1 5	0-76	11
Meal, barley	—	—	8 5	0 9	7 16	71	2 2	1-16	6-2
" maize	—	—	8 0	0 10	7 10	81	1 10	0-98	6-8
" " South African	—	—	7 10	0 10	7 0	81	1 9	0-94	6-8
" " germ	—	—	7 15	0 15	7 0	85	1 8	0-89	10
" locust bean	—	—	8 10	0 7	8 3	71	2 4	1-25	3-6
" bean	—	—	11 0	1 4	9 16	66	3 0	1-61	20
" fish	—	—	19 0	3 3	15 17	53	5 0	2-68	48
Maize, cooked flaked	—	—	9 2	0 10	8 12	83	2 1	1-12	8-6
" gluten feed	—	—	8 10	0 19	7 11	76	2 0	1-07	19
Linseed cake, English, 12% oil	—	—	13 0	1 8	11 12	74	3 2	1-70	25
" " " 9% "	—	—	12 2	1 8	10 14	74	2 11	1-58	25
" " " 8% "	—	—	11 17	1 8	10 9	74	2 10	1-52	25
Soya bean cake, 5½% oil	—	—	9 10†	1 19	7 11	69	2 2	1-16	36
Cottonseed cake—									
English, 4½% oil	—	—	6 2	1 6	4 16	42	2 3	1-20	17
" " Egyptian, 4½% "	—	—	5 10	1 6	4 4	42	2 0	1-07	17
Decorticated cottonseed meal, 7% oil	—	—	10 10*	2 0	9 10	74	2 7	1-38	35
Ground-nut cake, 6-7% oil	—	—	8 0†	1 6	6 14	57	2 4	1-25	27
Decorticated ground-nut cake, 6-7% oil	—	—	9 17†	2 0	7 17	73	2 2	1-16	41
Palm kernel cake, 4½-5½% "	—	—	8 5†	0 17	7 8	75	2 0	1-07	17
" " meal, 4½% "	—	—	8 15†	0 17	7 18	75	2 1	1-12	17
" " meal 1-2% oil	—	—	7 10†	0 17	6 13	71	1 10	0-98	17
Feeding treacle	—	—	6 7	0 9	5 18	51	2 4	1-25	2-7
Brewers' grains, dried ale	—	—	6 12	0 17	5 15	48	2 5	1-29	13
" " " porter	—	—	6 7	0 17	5 10	48	2 4	1-25	13
Malt culms	—	—	7 10§	1 6	6 4	43	2 11	1-56	16

* At Bristol.

† At Hull.

‡ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of January and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £9 per ton, its manurial value is 17½ per ton. The food value per ton is therefore £8 3s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 2d. Dividing this again by 22 4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1½d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 2s. 10d.; P₂O₅, 3s. 3d.; K₂O, 2s. 4d.

MISCELLANEOUS NOTES

UNDER the aegis of the University of London, a course of three lectures (illustrated with lantern slides) on "Diseases of Glasshouse Plants" will be given in the Botany Lecture Theatre, Imperial College of Science and Technology, Prince Consort Road, South Kensington, London, S.W. 7, by Dr. W. F. Bewley, Director of the Experimental and Research Station, Cheshunt, Herts. The dates of the lectures are Thursdays, March 6, 13 and 20, and the time on each day 5.30 p.m. The first lecture will deal with environment in relation to health and disease, and with diseases of the tomato and the rose; the second with diseases of the cucumber, carnation and chrysanthemum; and the third with disinfection of glass-houses and with soil sterilization. Admission to the lectures is free without ticket, and at the first of them the chair will be taken by Professor V. H. Blackman, F.R.S., Professor of Plant Physiology and Pathology in the Imperial College of Science.

* * * * *

THE following note has been communicated by Dr. Thos. Milburn, Midland Agricultural and Dairy College:—

Plant Lice on Swedes

Plant lice, like the poor, are always with us, but whether they develop to such an extent as to do serious injury to swedes or other farm or garden crops depends largely on weather and soil conditions. Hot dry weather may give swedes a check, and at the same time favour the growth of the lice, which under such conditions do serious harm to mangolds, beet, swedes, beans and other crops, as was seen in certain districts last summer.

The writer has from time to time observed that in manurial trial plots of swedes those plots which had been dressed with nitrate of soda suffered much less than those which had no such dressing—in fact, stood out remarkably green in an otherwise distressed crop. Such a dressing of a nitrogenous manure would undoubtedly improve the conditions for plant growth and thus enable the plant to "grow through" or "weather the storm" of the attack, but it would appear that there was in the above cases some other factor or factors operating because the plots which were given an equivalent amount of nitrogen in the form of sulphate of ammonia did not retain their fresh healthy growth.

It would be interesting to know whether any County Organizers, farmers or others who have been carrying out trials during the past season have noticed any beneficial effect in reducing the incidence of damage to swedes or other farm crops during the past dry summer, where dressings of nitrate of soda or other fertilizers have been used, and whether any benefit has accrued from occasional horsehoeing.

* * * * *

PRICES of agricultural produce during January were on average 48 per cent. above those ruling in 1911-13, or five and three points respectively above the figures

The Agricultural recorded a month and a year earlier. This
Index Number upward movement in the January index number is in accordance with that which

normally occurs at this time of the year, due to the fact that in most instances prices between December and January of the base period were reduced. Fat cattle, sheep and pigs were dearer during the month under review, but all other substantial alterations in values were in a downward direction.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	—
March	66	49	43	45	43	—
April	59	52	43	51	46	—
May	57	50	42	54	44	—
June	53	48	41	53	40	—
July	49	48	42	45	41	—
August	54	49	42	44	52	—
September	55	55	43	44	52	—
October	53	48	40	39	42	—
November	54	48	37	41	44	—
December	54	46	38	40	43	—

Grain.—Wheat became 1d. per cwt. dearer in January, and the index figure rose by two points to 30 per cent. above the level of the base years. Barley and oats, however, were 3d. per cwt. cheaper, and while the index number for the former was unchanged at 7 per cent. in excess of 1911-13, consequent upon reductions in the base period, that for oats was one point lower at 1 per cent. over pre-war. As compared with a year ago wheat was unchanged in price, but barley was cheaper by 1s. 6d. per cwt., and oats by 2s. 3d. per cwt.

Live Stock.—Values for fat cattle rose slightly on the month, secondary qualities averaging about 47s. per live cwt., and the index figure was eight points higher at 38 per cent. above 1911-13. Fat sheep were about $\frac{1}{4}$ d. per lb. dearer at 67 per cent. over pre-war. In both cases the rise in the index number was largely due to the reduction of prices in the base period. Substantial advances in the prices of fat pigs were recorded, which, coupled with reductions in the base years, caused the index numbers for baconers and porkers to appreciate by 26 and 21 points respectively, to levels of 90 and 98 per cent. over 1911-13. Quotations for dairy cows declined by about 15s. per head, but as this fall was proportionately less than that which occurred between December and January of the base period, the index figure rose by two points to 33 per cent. above pre-war. Store cattle were a little dearer at 25 per cent. over 1911-13. Store sheep also realized higher prices, and the index appreciated by seven points to 55 per cent. in excess of the pre-war level. Values for store pigs moved sharply upwards in sympathy with the rise in fat pig prices, and the index number was 29 points higher on the month at 137 per cent. over 1911-13.

Dairy and Poultry Produce.—Milk and cheese sold at practically the same figures as in December, but while the index number for milk showed no change at 67 per cent. above the base level, that for cheese rose by five points to 37 per cent. owing to a fall having occurred in 1911-13. The average price of butter was slightly lower and the index declined by one point to 44 per cent. over pre-war. Eggs became about 8d. per dozen cheaper at 40 per cent. in excess of 1911-13, as compared with 56 per cent. in January, 1929. Values for poultry, especially ducks and geese, moved upwards and the index figure rose by 10 points to 44 per cent. above the level of the base period.

Other Commodities.—The decline in potato prices which had been in evidence during the preceding two months was accelerated in January, and the index figure fell by 14 points to 4 per cent. below the pre-war level. In January, 1929, potatoes averaged 31 per cent. above 1911-13, and 74 per cent. in January, 1928. Vegetables, where altered, were rather cheaper than in December, but as proportionately greater reductions took place in the base years, the average level was eight points higher at 58 per cent. above pre-war. Quotations for hay showed little alteration at 38 per cent. over 1911-13, but the index number for wool fell by seven points to 32 per

cent., an appreciable decline in values having occurred in the latter part of January. A year ago wool averaged 72 per cent. above pre-war.

Index numbers of different commodities during recent months and in January, 1928 and 1929, are shown below :—

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1928	1929				1930
	Jan.	Jan.	Oct.	Nov.	Dec.	Jan.
Wheat	34	30	27	24	28	30
Barley	40	26	21	11	7	7
Oats	39	34	12	6	2	1
Fat cattle	28	35	31	33	30	38
Fat sheep	63	67	55	53	53	67
Bacon pigs	34	40	50	56	64	90
Pork pigs	44	52	64	70	77	98
Dairy cows	26	33	34	33	31	33
Store cattle	24	23	11	15	17	25
Store sheep	42	59	53	51	48	55
Store pigs	47	52	95	108	108	137
Eggs	77	56	81	54	47	40
Poultry	38	45	45	43	34	44
Milk	66	70	55	67	67	67
Butter	47	53	55	50	45	44
Cheese	61	78	37	32	32	37
Potatoes	74	31	17	18	10	—4*
Hay	18	6	40	41	41	38
Wool	58	72	42	41	39	32

* Decrease.

* * * * *

ACCORDING to returns made to the Ministry by the beet sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during January, 1930, together with the quantity produced during the corresponding month in 1929, was :—

	cwt.
January, 1930	467,730
January, 1929	182,810

The total quantities of sugar produced during the two manufacturing campaigns to the end of January were :—

	cwt.
1929-1930	5,799,500
1928-1929	3,899,728

APPOINTMENTS

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND AND WALES.

School of Agriculture, University of Cambridge

Mr. A. de M. Chesterman, P.A.S.L., has been appointed additional lecturer in Estate Management.

Mr. W. K. Hubble, B.A., has been appointed Assistant Demonstrator in Agriculture.

Studley College, Warwickshire

Miss A. M. Rennards has been appointed Farm Lecturer and Instructress *vice* Miss S. E. B. Blair, B.Sc. (Agri.), resigned.

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Bedfordshire : Mr. J. W. Dallas, B.Sc., has been appointed Agricultural and Horticultural Organizer.

Hampshire : Miss K. Boyes, N.D.D., N.D.P., B.D.F.D., has been appointed Superintendent of Dairying.

Northumberland : Mr. W. Craib, B.Sc., has been appointed Assistant Agricultural Organizer.

Mr. J. J. O'Carroll has been appointed Assistant Instructor in Horticulture.

Somerset : Mr. D. J. G. Black, B.Sc., has been appointed Assistant Agricultural Organizer, *vice* Mr. J. W. Dallas, B.Sc.

Suffolk (East and West) : Miss F. M. Cawter, N.D.D., B.D.F.D., has been appointed Instructress in Dairying, *vice* Miss C. E. Speakman.

COUNTY AGRICULTURAL EDUCATION STAFFS : WALES

Flint : Mr. H. E. Davies has been appointed Poultry Instructor.

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Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on Tuesday, February 4, 1930, at 7 Whitehall Place, London, S.W., the Chairman, The Right Hon. the Viscount Ullswater, G.C.B., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying these decisions into effect.

Worcestershire.—An Order to come into operation on March 2, 1930, and to continue in force until February 28, 1931, fixing minimum and overtime rates of wages for male and female workers. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 41½ hours in the week in which Good Friday falls, and 50½ hours in any other week in summer ; 39½ hours in the week in which Christmas Day falls, and 48 hours in any other week in winter, with overtime at 8d. per hour on Good Friday and Christmas Day and 9d. per hour on any other day. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 5½d. per hour.

Denbigh and Flint.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and

female workers from February 16, 1930, until February 15, 1931. The minimum rate in the case of team-men, cattlemen, cowmen, shepherds or bailiffs of 21 years of age and over is 37s. per week of 61 hours, and, in the case of other male workers of 21 years of age and over, 30s. 6d. per week of 50 hours, with overtime in each case at 9d. per hour. In the case of female workers of 18 years of age and over, the minimum rate is 5d. per hour with overtime at 6½d. per hour.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Enforcement of Minimum Rates of Wages.—During the month ending February 15, legal proceedings were instituted against 15 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County		Court	Fines			Costs			Arrears of wages			No. of workers involved	
			£	s.	d.	£	s.	d.	£	s.	d.		
Gloucester	..	Lydney	..	4	0	0	—	—	26	19	10	1	
Kent	..	Tonbridge	..	0	10	0	—	—	7	12	6	1	
Lancaster	..	Bolton	..	1	10	0	0	3	0	36	0	3	
Northampton	..	Towcester	..	*			0	10	0	25	0	1	
N'umberland	..	Hexham	..	*			0	18	0	8	16	1	
Somerset	..	Temple Cloud	..	2	10	0	3	3	0	35	17	3	
Stafford	..	Leek	..	—			1	4	0	23	14	3	
Wilts	..	Chippenham.	..	0	10	0	—	—	9	5	3	1	
"	..	"	..	0	10	0	—	—	14	6	10	1	
"	..	"	..	0	10	0	—	—	16	4	4	1	
"	..	"	..	1	0	0	—	—	53	13	1	2	
Worcester	..	Kidderminster	..	1	0	0	1	11	0	27	17	2	
Yorks, W.R.	..	Pontefract	..	Case dismissed								1	
				£12	0	0	£7	9	0	£285	7	2	21

* Dismissed under Probation of Offenders Act.

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Foot-and-Mouth Disease.—The country continues free from outbreaks of foot-and-mouth disease, no case having been confirmed since that at Goring-by-Sea, Worthing, West Sussex, on December 23, 1929.

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NOTICES OF BOOKS

Agricultural Geology.—Frederick V. Emerson, Ph.D. Revised by John E. Smith. Pp. xvi+377. Illustrated. (London : Chapman and Hall. 1928. Price 16s. net.)

Professor Emerson hoped that this book, prepared primarily as a textbook for agricultural students and first published in 1920, would also be useful outside the classroom. For this reason, he did his best to make the treatment of his subject as untechnical as possible, without sacrificing scientific accuracy. Mr. Smith has made only the few alterations and expansions of the work which have become necessary owing to increased knowledge of the subject. Each chapter is supplied with a list of books for further reading and a set of questions to be answered by the student.

Economic and Financial Results on Five Dairy Farms, 1924-25, 1925-26, 1926-27.—By Edgar Thomas, B.Sc., B.Litt., and C. H. Blagburn, B.Sc., N.D.A. Pp. 36. (Department of Agricultural Economics, University of Reading; Bull. XXXVII. Accounting Studies No. 2. 1929. Price 1s.)

The character of the economic reports of their investigations, which have been published by the various Advisory Economists, is well known to readers of this JOURNAL. It would perhaps be useful to read this report in conjunction with "Progress in English Farming Systems," noticed last month, although the investigators specifically state that the results should be interpreted in terms of the farms to which they relate, and that they have made no attempt to use the accounts as a basis for drawing general conclusions regarding the economic position of the dairying industry. The data provided are not, of course, sufficiently comprehensive for that purpose.

The Pig Breeders' Annual for 1929-30 and Year Book of the National Pig Breeders' Association.—Pp. 148. (Published by the Association, 92 Gower Street, London, W.C. 1. Price 2s. 6d.)

In the course of its nine years of life this Annual has developed from a paper-bound volume to a handsome cloth-bound book of nearly double its former size. This year the foreword is written by Viscount Folkestone, and, in addition to articles by authorities dealing with feeding, diseases, fecundity, and marketing, etc., the volume contains articles describing the pig industry in different parts of the world. There is also the usual information as to curers, research institutions, and statistics, which cannot fail to interest and to be of service to the breeder.

Potato Varieties Immune to Wart Disease (*Krebsfeste Kartoffel-sorten. Variétés de Pommes de terre résistantes à la galle verruqueuse*).

By Dr. K. Snell. (Berlin: Paul Parey. 1929. Price R.M. 5.)

This little book is No. 7 of the well-known series of Pocket Atlases issued by Paul Parey in Berlin. The author is on the staff of the Biologische Reichsanstalt in Dahlem, and is an authority on potato varieties in Germany. Like the others in the series, the booklet consists of coloured drawings, by A. Dressel, faced by the relevant text, which, in the present instance, is in German, English and French. There are 24 coloured plates in all. Twenty-one of them deal with this number of varieties, illustrations being given in each case of flowers, foliage and tubers, including sprouts. On the remaining three plates the tubers and sprouts alone of 22 further varieties are depicted. Some of the varieties dealt with are susceptible to Wart Disease, the majority are "krebssfest." This term is translated in the English text "immune," but the word is not well chosen. A "krebssfest" variety may be actually immune from Wart Disease attack; on the other hand it may be merely highly resistant, an important distinction. The Dutch variety Roode Star is included amongst those said to be "krebssfest," but in Holland, at any rate, it regularly becomes slightly attacked when exposed to infection.

So far as illustrations of this character go, there is little or nothing to quarrel with in those here presented. It must be remembered, however, that a satisfactory working knowledge of potato varieties cannot be obtained from books, however well illustrated. It can be acquired only by intensive study of the living plants in the field. It is questionable, therefore, whether this Atlas will be of much real service in this country, and particularly so seeing that, judging from the names given, two or three only, of the varieties dealt with, are commonly grown here. On the Continent, however, this handy illus-

trated list of the chief Wart-resistant varieties of potatoes will no doubt be found useful.

Farm Machinery and Equipment.—By Harris Pearson Smith, M.S. Pp. xii+448. Illustrated. (London: McGraw-Hill Publishing Co., Ltd. 1929. Price 16s. 3d. net.)

This is an American book and contains chapters dealing with machinery for two of the great American staples, corn (maize) and cotton, which can be of little service to the British farmer. The mechanization of agriculture has, however, progressed farther in the United States than in this country, and the book contains much material of general interest.

The book follows the lines which seem to have become usual in such productions: Part I deals with the principles of farm machinery, and is an exposition of the more important phases of physics which influence the design, operation and adjustment of the machines described in detail in the later chapters. The arrangement of the matter follows the seasonal necessities for the use of machinery on the farm, and an endeavour has been made to include all the latest developments. Thus the combine harvester-thresher is dealt with as fully as present conditions of knowledge permit.

Although it is some twenty-two years since Davidson and Chase's *Farm Machinery and Farm Motors* appeared, the progress in farm mechanization has demanded that a number of books on the subject should be written both in England and America, and Mr. Smith's book is worthy of being read in England with those more purely applicable to British conditions, such as J. R. Bond's *Farm Implements and Machinery* and D. N. McHardy's *Modern Farm Machinery*.

America Challenged.—A preface to a point of view. By Lewis F. Carr. Pp. 322. (New York: The Macmillan Co. 1929. Price 15s. net.)

The agrarian problem is no less urgent in America than in Britain or the other countries of the world. Mr. Carr, however, shows that its importance in the United States is not yet fully realized by the prosperous urban population of that country, and he sets out to give them the facts and figures necessary to prove the position to the most doubtful "man from Missouri." Having demonstrated the fact that American agriculture is not earning a living commensurate either with the high standard of the urban population or with the effort required to render it productive at all, he suggests that the causes of the trouble, internally, are the spread between farm and retail prices of the agricultural products, the protected price of the manufactured commodities the farmer must buy, and externally by the fact that the farm prices of the five great farm staples are ruled by world rather than American prices.

His proposed remedy is to decrease the spread between the farm and retail price by some system of more efficient distribution, which shall reduce its cost and enable a higher price to be paid to the farmer. This end, he suggests, may be obtained by co-operation between the growers of some of the crops, stimulated by Government action, and by informed popular opinion in urban centres; and he offers various methods of procedure. As an example of success he instances the milk supply of Hartford, Conn., and of New York, and makes the point that it will be necessary to control the disposal of surpluses in order to maintain price levels.

In the case of the export crops, Mr. Carr suggests the adoption of a system of maintaining an American price level within the country, and the disposal of the surplus at the lower world prices, and offers tentative methods for the attainment of this object.

He points out the repercussions upon industrial and national life of a depressed agriculture, and shows that much industrial prosperity can be secured by increasing the purchasing power of the agricultural community. It is, of course, true that America has been primarily concerned with export business in its staple crops, while Great Britain is primarily concerned with the maintenance of price levels for crops insufficient to provide for the requirements of the population and faced with the competition of supplies drawn from all over the world, but there is much in the book that is useful in a consideration of our own problem as well as that of the United States.

The Reclamation of Exmoor Forest.—By C. S. Orwin, M.A. Pp. x + 172. (London: Humphrey Milford, Oxford University Press. Price 10s. 6d. net.)

The story of enclosure has been told in general terms by a number of writers, but, as Mr. Orwin says, the actual steps by which a particular district was dealt with have rarely been described. We know that the measures consequent upon the enclosure of open-field arable land must have followed a more or less obvious routine: either the new enclosures were laid down, or they continued in arable cultivation of an improved kind. The results of the enclosure of the waste, however, have not been so closely examined, and all who are interested in this subject will welcome this history of an attempt to bring into cultivation one of this country's largest single areas of rough grazing that has been conquered.

It is true that the reclamation of Exmoor Forest took place in the 19th century, and that it did not begin until after Waterloo, but it is clear from Mr. Orwin's story that the motives that actuated the improvers of the later 18th century were very present in the mind of John Knight, when he first acquired the property from the Crown, and proceeded with the work.

John Knight came of a family of ironmasters, who had become landowners, and whose 18th century apotheosis was Richard Payne Knight, who had been a dilettante and engaged in controversial discussions of the fashionable "picturesque" with other critics of the day. His brother, a famous cattle breeder and horticulturist, was the father of John, who undertook the reclamation of Exmoor.

With such forbears and with the general trend of the reclamation work of the 18th century in his mind, John Knight could hardly fail to make mistakes, as did so many who hoped to grow crops on unsuitable land, and to try to breed the improved beasts and sheep in an unsuitable environment. We read of enclosures made and fenced, which showed no sign of improvement in the 18th century, and of lands ploughed up for wheat which had proved so unprofitable under tillage that they had fallen down to grass again before many years had passed.

Nevertheless, in spite of the failures consequent upon a mistaken policy in the first half of the 19th century, we are almost tempted to quote Macaulay's exaggerated description of the improvement in the country at large, and apply it to the work of the Knights, who, even if they did not turn "a wild into a garden," at least took over a large area which was for practical purposes an isolated and desert tract, producing only a fraction of what it might, and made it productive.

It was not, however, until the middle years of the last century that the system of trial and error had shown which was the true method of dealing with this somewhat intractable district, and the book shows how protracted are the efforts needed in the reclamation of land to profitable husbandry.

While it is not possible to generalize from the specific instance described in this book, because the geological strata and climate of Exmoor, and even its extent, give it individual features not readily to be duplicated in the country, a careful perusal of Mr. Orwin's book should afford some instruction in the patient and devoted labours which have led to the making of the land of our country.

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SELECTED CONTENTS OF PERIODICALS

Agriculture, General and Miscellaneous

- Small Farms in Northern Ireland. *D. A. E. Harkness*. (Econ. Jour., **XXXIX**, 154 (June, 1929), pp. 219-225.) [333.38 (416); 338.1 (416); 63 (416).]
- Some Problems in Farm Management. *J. Wyllie*. (Trans. Highland and Agric. Soc. of Scotland, Fifth Series, Vol. **XLI**, 1929, pp. 21-46) [63.191.]
- Agricultural Co-operation in Scotland. *T. G. Henderson*. (Trans. Highland and Agric. Soc. of Scotland, Fifth Series, Vol. **XLI**, 1929, pp. 71-98.) [334 (41).]
- Some Aspects of the Problem of the Rural Exodus. (Int. Rev. Agric. **XX**, 3 (March, 1929), Part II. (Agric. Econ. and Soc.), pp. 112-120.) [325.3.]
- Agriculture and Economic Geography in the Eighteenth Century. *G. E. Fussell*. (Geographical Jour., **LXXIV**, 2 (Aug., 1929), pp. 170-178.) [63 (09); 91.]
- Agriculture in Aberdeenshire in the Eighteenth Century. (Scottish Jour. Agric., **XII**, 3 (July, 1929), pp. 314-317.) [63 (41); 63 (09).]
- The Agricultural Revolution in Scotland, 1750-1810. *J. A. Scott Watson*. (Trans. Highland and Agric. Soc. of Scotland, Fifth Series, Vol. **XLI**, 1929, pp. 1-20.) [63 (41); 63 (09).]

Soils

- The Availability of the Potassium in Some Scottish Soils. *R. Stewart*. (Jour. Agric. Sci., **XIX**, 3 (July, 1929), pp. 524-532.) [63.113.]
- A Rapid Electrometric Method for Determining the Chloride Content of Soils. *R. J. Best*. (Jour. Agric. Sci., **XIX**, 3 (July, 1929), pp. 533-540.) [63.113.]
- The Cobaltinitrite (Volumetric) Method of Estimating Potassium in Soil-extracts. *G. Milne*. (Jour. Agric. Sci. **XIX**, 3 (July, 1929), pp. 541-552.) [63.113.]
- The Manurial Requirements of Soils. Two Modern Methods of Estimation. *R. Stewart*. (Scottish Jour. Agric., **XII**, 3 (July, 1929), pp. 251-262.) [63.113; 63.16.]

Field Crops

- The Cutting of Seed Potatoes. *J. G. Rhynshart*. (Jour. Min. Agric. N. Ireland, **II** (1929), pp. 78-83.) [63.512.]
- The Mechanization of Beet Harvesting. (Int. Rev. Agric. **XX**, 3 (March, 1929), Part I. (Agric. Sci. and Pract.), pp. 113-117.) [63.17; 63.3433.]
- The Composition of Swedes. (Scottish Jour. Agric., **XII**, 3 (July, 1929), pp. 310-312.) [63.332; 63.60433.]
- The Effect of Fresh Straw on the Growth of Certain Legumes. *H. G. Thornton*. (Jour. Agric. Sci., **XIX**, 3 (July, 1929), pp. 563-572.) [63.163; 63.165; 63.32.]

Note on the Effect of Sodium Silicate in Increasing the Yield of Barley. *A. D. Hall*. (Jour. Agric. Sci., xix, 3 (July, 1929), pp. 586-588.) [63.167; 63.313.]

Investigations on Yield in Cereals, VI. (A) A Developmental Study of the Influence of Nitrogenous Top-dressing of Wheat. (B) A Measurement of the Influence of Disease ("Take-all") upon the Yield of Wheat. *L. R. Doughty, F. L. Engledow and T. K. Sansom*. (Jour. Agric. Sci., xix, 3 (July, 1929), pp. 472-490.) [63.31; 63.311; 63.24.]

Failure of Cultivated Varieties of Oats to Grow. *J. Anderson*. (Scottish Jour. Agric., xii, 3 (July, 1929), pp. 320-324.) [63.314.]

Some Observations on the Nitrogenous Manuring of Grassland. *H. W. Gardner, J. Hunter Smith, J. W. Reid and H. R. Williams*. (Jour. Agric. Sci. xix, 3 (July, 1929), pp. 500-523.) [63.33; 63.33-16.]

Notes on Pure Strains of Flax. *W. J. Megaw*. (Jour. Min. Agric., N. Ireland, xi (1929), pp. 14-25.) [63.34111.]

Horticulture

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